
Chapter 29

Population Control

... there is no single case in the world where scientific evidence, dispassionately evaluated, supports the view that commercial catches will increase if seals are "controlled" by "culling" (Holt, 1985).

We simply cannot continue to absorb the direct costs and enormous losses associated with these surplus seal populations. It is clear that seal populations must be controlled to maintain a balanced marine ecosystem and the peoples and communities [that] depend upon it (Fisheries Association of Newfoundland and Labrador Ltd., 1985).

Introduction

In their submissions to the Royal Commission, a number of organizations and individuals expressed the view that it was desirable to limit the numbers of seals with the aim of benefiting the fishing industry, or increasing the availability of fish or other marine products for human use. Others questioned either the reality of these benefits or the ethical justification for killing seals for this purpose.

The principal reasons adduced for such actions were to minimize:

- reduction of commercial fish stocks by seal predation;
- damage to fishing gear and loss of fish in or on the gear by seal action;
- losses and costs to the industry resulting from the incidence of nematode parasites that depend on seals as a final host.

The seal species about which concern was particularly expressed were:

- grey seal;
- harp seal, in the event of the commercial hunt's ceasing;

- harbour seal, on both coasts;
- Steller and California sea lions.

Most of the considerations which bear on the balance of the arguments for and against continuation or extension of population-control policies have been discussed in detail elsewhere in this Report. The purpose of the present chapter is to bring this information together in summary form as a basis for reaching appropriate conclusions.

In providing for the killing of seals for the purpose of reducing numbers, the government has followed two principal strategies. The first strategy has been organized hunts by government-employed hunters, working to arranged plans. This practice is generally called "culling" in Canada, and it will be so referred to here. It should be noted, however, that this is a rather specialized use of the word, since "culling" as defined in most dictionaries is primarily a selective process and, where killing is involved, is undertaken with the aim of improving the genetic quality of the herd or other population. In the culling of seals, however, the purpose is usually to kill the desired number of animals, and selection, if any, is made only on a basis of age or sex. The second strategy used in procuring the killing of seals for population control has been the offering of a bounty for each seal killed, the bounty being paid on the presentation of a specified identifiable piece of the animal. This practice is generally referred to as "bounty hunting" to distinguish it from commercial hunting or harvesting.

Other management actions which might be taken to reduce the numbers of seals with the aim of benefiting the fishing industry include allowing fishermen to kill seals, either generally or under specified conditions, and providing encouragement and assistance to commercial harvesting. The advantages and disadvantages of these strategies will be discussed later in this chapter.

Submissions Relating to the Question

The Department of Fisheries and Oceans (Canada, DFO, 1985) provided the Royal Commission with valuable information on the culling and bounty programs which have been undertaken in the past. Sea lions and harbour seals on the west coast, and grey seals and harbour seals on the east coast have been subjected in the past to kills of this kind, but since 1976, only grey seals have been hunted. Large numbers of grey seals were culled in 1983 (2,385); the very small (112) and zero kills that took place in 1984 and

1985 respectively were stated by DFO to be intended to avoid interfering with a tagging program. The Royal Commission therefore assumes that DFO's policy does not exclude culling in suitable circumstances.

The Minister of Fisheries for Prince Edward Island (Prince Edward Island, DFL, 1985), and the Departments of Fisheries in New Brunswick (New Brunswick, DOF, 1985) and Nova Scotia (Nova Scotia, DOF, 1985), all expressed concern about the dangers of increasing seal populations and supported programs to reduce their numbers. All these provinces wished for action on grey seals, and Prince Edward Island specifically urged a bounty on harbour seals, also.

The Government of Newfoundland and Labrador (1985) indicated special interest in the relation of harp seals to the fisheries. It advocated a strictly controlled cull of this species if the market demand did not give rise to a commercial kill sufficient to "protect the fishery resources or maintain the overall health of the . . . herd itself."

Some leading fishing-industry organizations also supported action to control seal numbers. The Fisheries Council of Canada (1985) called for a reduction in the number of grey seals, with the particular aim of reducing the parasite problem; it also appeared to be concerned about the possible effects of expansion of the harp seal population if the present hunt were terminated. A similar view was expressed by the Fisheries Association of Newfoundland and Labrador Ltd. (1985).

The Eastern Fishermen's Federation, whose members operate in the Maritime provinces, provided data on damage caused to fishing gear and catches by grey and harbour seals (Farmer and Billard, 1985), and suggested that steps should be taken to control the numbers of these species in view of the alleged recent increases (Billard and Farmer, 1985).

The Prince Rupert Fishermen's Cooperative Association (1985) expressed concern in its submission about competition between fishermen and seals for fish, particularly salmon, about loss of catch and damage to gear when seals attack fish in nets, and about the effects of nematode parasites in increasing processing costs and reducing value. It urged that the number of seals and sea lions should be reduced "in areas where their abundance has become a problem." It opposed bounty hunting as wasteful and supported development of a commercial harvest as an alternative means of seal-population control.

The World Society for the Protection of Animals tabled documents (Scott, 1985) in which, having pressed for the termination of the commercial seal hunt, it proposed that "a scientific cull" be undertaken "should it prove necessary by scientific analysis to remove a number of seals in the interests of environmental protection." It did not define the "interests of environmental protection" or suggest how these might relate, if at all, to what the fishing industry would appear to regard as preventing an overpopulation of seals.

A number of organizations interested in the protection of seals made presentations which implicitly opposed culling or bounty hunting. A specific statement was presented by Greenpeace International, which tabled its formal policies regarding seals (Bøe, 1985). This policy includes opposition to "the culling and bounty hunting of seals done in the name of protecting fish stocks." It specifically applied this policy to harp, grey and harbour seals.

Should Seal Populations Be Controlled?

The opposition to culling was based on two distinct arguments. One is a technical argument, that the estimates of losses caused by seals and of the benefit to be gained by reducing their numbers are not accurate enough to justify killing the animals. The other is the ethical argument that the economic benefits, even if as large as claimed, would not justify the killing. Dr. S.J. Holt (1985), in his brief to the Royal Commission, discussed the first argument. He examined some mathematical aspects of the relationship between the size of the seal populations, the amount of fish they consume, and the resulting amount available to the fishing industry. He stressed the lack of knowledge of the relationship between the various species in the marine biological community and concluded that "engagement in a seal-culling programme without such knowledge means taking an unknown risk with respect to the seal stocks, possibly at considerable expense . . . with little prospect of significant benefit to the fisheries."

Uncertainty

There are good reasons, which have been discussed in Chapters 24, 25 and 26, why it is difficult to obtain accurate estimates of any of the three classes of loss to the fishing industry. Suggestions have been made in those chapters as to how some of these estimates could be improved.

The estimates of the extent of gear damage and of the losses caused by parasites can probably be improved, although they will never be as precise as other economic figures, such as the size or value of the catch.

The uncertainties surrounding the effect of competition between humans and seals will be much less easy to reduce; they arise both from inadequacies of the data (e.g., what species of fish are eaten by a given species of seal in a given area at a given season), and from problems of interpretation (e.g., what would be the effect on fisheries of changes in the consumption by seals of fish of a given species by a given amount). Further research should ultimately help to reduce the bounds of uncertainty, although a very great increase in the amount of data will be required; but because so much of the uncertainty arises from problems of interpretation, it is likely to remain impossible to express the range of likely values of the losses in terms of statistical distributions. The limits quoted in Chapter 24 for the present losses attributable to the various species of seals are based on subjective assessment of the likely level of uncertainty in the various parameters involved and not on any statistical analysis of the data.

Nevertheless, the Royal Commission believes that the estimates of the losses which it has developed are reasonable, that they provide a reliable measure of the general level of losses caused by seals to the fishing industry, and that this measure can be used as a basis for discussion of the desirability or undesirability of controlling seal populations. The possibility does exist that the true values lie outside the ranges quoted, but it seems proper to require those wishing to assert that the values are significantly too high or too low to go beyond a simple assertion of this possibility. They should suggest what assumptions made in deriving the estimates presented here are, in fact, wrong and propose alternative assumptions, if possible with some supporting evidence, and examine the consequences of using these alternative assumptions.

Public Opinion

Public opinion on the acceptability of killing seals for the economic benefit of the fishing industry will depend to a large extent on the magnitude of the benefit perceived, as well as on the numbers of seals it is proposed to kill. In general it can be expected that the greater the benefit, the larger the proportion of the population that would consider justifiable the killing of, say, 10,000 seals. The monetary amounts involved are so large, however, compared to those usually handled by most people that it may be difficult,

without further study, to know what proportion of the public would regard an annual saving of, say, \$10,000,000 as adequate justification, compared to the proportion which would regard \$200,000,000 as adequate justification.

The question of uncertainty will also affect public opinion. If it were known, for example, that the loss was definitely \$100,000,000, public opinion might be different from public opinion if it were known that while the best estimate of the loss was \$100,000,000, it might well amount only to \$25,000,000.

The extent of the uncertainties must also modify the way that management measures are applied. It will not be sufficient to determine, on the basis of some chosen estimates, what appears to be the best policy and continue to apply it without further review. It will be necessary to review regularly what is happening to the stocks and to the estimate of damage, and take action accordingly. It must be recognized, as discussed in Chapter 24, that it will be difficult, unless very drastic changes occur in seal populations, to demonstrate directly the impact of measures to control seal populations on the availability of fish to fishermen, and to differentiate them from changes due to the effects of natural fluctuations. This difficulty emphasizes the need to regard all population control operations, including a formal decision not to implement a cull, and thereby to allow the population to expand, as experimental and to ensure that they are accompanied by well-planned research programs to determine their effects, both on seal populations and on fish stocks and catches. This point is considered further in a later section of this chapter.

The point made by Dr. Holt (see above) must be recognized, but a lack of complete knowledge is not the same thing as lack of any knowledge. In dealing with any natural system it will always be possible to argue that knowledge is incomplete, so that failure to take action because full knowledge is lacking could be regarded as irresponsible if the available evidence points clearly in one direction. Thus, the fishing industry might regard failure to take action in relation to some seal populations as irresponsible in the same way that earlier failures to control the taking of seals and other marine resources are rightly regarded by conservation groups as irresponsible.

In Chapter 11 it was shown that there is a strong view among the public that it is wrong to kill seals unless there is a good reason for so doing. This is a matter of demonstrable fact that must be taken into account in setting public policy.

While it is clear that the public demands an adequate justification for killing seals, it is less clear what benefits from killing seals would constitute a justification. In this matter there seems to be some inconsistency in the public attitude towards killing seals and killing other species for sport or for food. Culling of seals for economic benefit to the fishing industry lies in the grey area between hunting by aboriginal peoples for subsistence (which seems to be acceptable to nearly everyone) and killing seals for wholly trivial purposes (which is generally rejected).

In the face of uncertainty, the choice of action to be taken has sometimes been seen as implying a need to decide between giving the benefit of the doubt to the seals or to the sealers and fisheries. This view can over-emphasize the degree of conflict between the two sets of interests. What should also be emphasized when uncertainties exist is the need to look at the effects of errors of different kinds on both seals and fishermen, and to recognize that at least for large errors, the effects of making a mistake in one direction may be much more dramatic than those of making errors in the other. For example, if a seal stock is very severely depleted by a large overestimate of the numbers that can be killed, it will take a long time to rebuild, while if too few seals are killed, this error can easily be rectified. Similarly, errors that lead to a large build-up in parasites may take a long time to rectify. In addition to showing the need to avoid errors in the direction in which effects may be harmful and hard to rectify, this points to the need to approach these problems in a step-by-step manner. Actions to change the current situation should not only be subject to careful review before further action is implemented, but in most cases, too, the steps should be no larger than is necessary to have a reasonable chance of achieving identifiable results. The smaller the step, the more difficult will it be, and the longer will it take, to reach any conclusions about the resulting changes.

Effect of Fishing

Another factor which can affect the development of policy on the control of seal populations is the effect of external influences, particularly fishing and environmental changes, on fish stocks. If a stock becomes less abundant because of overfishing or changes in climate, it may be that no reduction in the predation by seals could restore it to its earlier abundance. Such reduction might, however, bring about some increase in abundance which would lead to some additions to catches. Nothing much can be done about climatic changes, but if a stock has been overfished then the important question which arises is whether any reduction of seal populations is justifi-

able until all possible steps have been taken to bring fishing pressure to a proper level.

The fishing industry is well aware of the problems of overfishing and the need to remedy them. The conservation groups have emphasized that seals should not be the scapegoats for failures in fishery management. Differences of opinion will arise when action has been taken to correct overfishing and the industry still believes that it would gain by a reduction in seal numbers.

If the adjustment of the amount of fishing has gone as far as it should, and the fishing mortality has been reduced to an appropriate level, overfishing should no longer be an issue in determining future policy on the control of seal populations.

A more common situation at present is one where some, but not complete, action has been taken; the less controversial methods of reducing fish mortality may have been taken by means such as phasing out foreign fishing, for instance, but the amount of fishing may be still too high according to objective measures of optimum rates of fishing.

Further progress towards the optimum fishing level may be made difficult by such practical problems as finding alternative employment in isolated areas where there are too many fishermen for the local resources to support.

In this situation the fishing industry's reaction would presumably be that if control of fishing activity has gone as far as is immediately practicable, and if measures to limit the consumption of fish by seals would give some benefits, then these measures should be taken. Some environmental groups might believe, however, that as long as benefits can be obtained by more stringent controls on the amount of fishing or by other resource-management measures, these measures should be taken, rather than measures to benefit fishermen by controlling seals (e.g., Bøe, 1985).

This argument is a special case of the general benefit-cost argument concerning the morality or ethics of killing seals, discussed in Chapter 12. It suggests that when looking at a particular situation where the killing of seals might be considered, the analysts should examine not only the expected benefits from the kill, but also the extent to which somewhat similar benefits might be obtainable by other methods, including control of the amount of fishing, and the social and economic costs of these methods.

The Royal Commission believes that the diversity and strength of public opinion about the killing of seals is such that no decisions to implement a cull or bounty program should be made without prior public consultation and implementation of a careful program to explain the reasons to the public and to determine public reaction. Any program undertaken without this consultation would risk incurring wide opposition and could lead to the same kind of anti-sealing campaign that occurred over the hunt of whitecoat harp seal pups.

Past and Present Practices

Only a few seal species have been the subject of organized attempts to reduce their numbers in Canada. These are described below.

East coast

Grey Seal

Culling was undertaken in 1967–1983, but only in a limited area in and near the southern part of the Gulf of St. Lawrence. Something over 17,000 animals were killed in this period, an average of 1,000 per year. Killing was done on the breeding grounds, and 80% of the seals killed were pups.

A bounty was initiated in 1976; the Department of Fisheries and Oceans stated that this was largely as “a measure to allow fishermen to destroy seals which were damaging their nets and traps” (Canada, DFO, 1985). The number of bounties claimed in 1976–1983 was 5,751, an average of about 720 per year, but the number of seals killed by bounty hunters may have been as high as twice this number (Canada, DFO, 1985, p. 81).

Harbour Seal

There has been no cull of harbour seals on the east coast. There was a bounty on harbour seals until 1976. Since that time special permits have been issued in certain localities to allow fishermen to destroy “nuisance harbour seals.” Between 1950 and 1971, the number of harbour seals for which bounties were claimed was about 16,000, of which approximately 27%

were pups; the annual kill declined from about 1,000–1,400 in the early years to about 400 at the end of the period (Boulva and McLaren, 1979). No data are available on the number of harbour seals killed under the bounty scheme after 1971, or under special permits (Canada, DFO, 1985).

West Coast

Steller Sea Lion

This species has been subject to a series of culling campaigns over several periods of years beginning in 1912; these campaigns are discussed in some detail in Chapter 22. The last such campaign was carried out in 1958–1966, when about 11,000 sea lions were killed, an average of 1,200 per year. There has never been a bounty scheme for this species, and since 1970 it has been protected under the federal *Fisheries Act* (Canada, DFO, 1985, p. 89). About three-quarters of the animals were killed on the rookeries, and about 15% of the total killed were pups (Bigg, 1985a).

California Sea Lion

This species was scarce on the Canadian coast until the time when protection was extended to it under the federal *Fisheries Act*; it has therefore not been the subject of any significant control program.

Harbour Seal

Harbour seals were killed for the purpose of reducing numbers during 1914–1969, mainly under a bounty scheme (up to 1964), but also by organized hunting and by fishermen. The average number of bounties claimed over 1914–1964 was about 2,900 (Canada, DFO, 1985; Bigg, 1969). No data have been available on the numbers killed in organized hunts or by fishermen. The total number killed by bounty hunters would be substantially more than the number of bounties claimed, perhaps twice as many.

Effects of Past Control Operations on Seal Populations

The available information on the sizes of the seal populations, the changes over the years, and the current trends have been discussed in some

detail in Chapters 21 and 22. The present section is concerned with that part of this information which bears on the effects, if any, produced by the former control programs.

East Coast

Grey Seal

The grey seal population has been increasing in recent years. The data bearing on this have been discussed in Chapter 21, and have led to the conclusion that the population as a whole is almost certainly increasing. On one major breeding ground, Sable Island, where no culling has been undertaken, the population is increasing by perhaps as much as 13% per year. There are, however, no reliable data to show whether, and at what rate, the population is increasing in the parts of the southern Gulf where culling has been going on. Thus, although the overall population is almost certainly increasing in spite of the culling, it is by no means clear whether this increase is primarily a result of the expansion of the Sable Island population.

Harbour Seal

As stated in the review of the status of harbour seals (Chapter 21), the bounty program in effect between 1927 and 1976 produced a decline in the population; between 1950 and 1970 this decline occurred at a rate of about 4% per year. Since the bounty was terminated in 1976, the population has been slowly increasing, probably at about 1%–2% per year. Despite this apparently slow rate of increase, the Royal Commission was informed (Canada, DFO, 1985; Prince Edward Island, DFL, 1985) that fishermen were concerned about increasing damage from these seals. It may be that this concern is partly the result of seals becoming less timid in approaching fishermen's gear in the absence of hunting.

West Coast

Steller Sea Lion

The control program in place in 1913–1969 led to a reduction in the breeding population of the Steller sea lion on the British Columbia coast from about 11,000–14,000 to about 4,800–6,600. The population did not re-

build after hunting ceased in 1969, but establishment of a large rookery just across the Alaska border has probably enabled the number of Steller sea lions feeding in B.C. waters to return to a level similar to, or not much smaller than, that in 1913. If this is so, any further major increase in this population seems unlikely.

Harbour Seal

During the period prior to 1970, when the harbour seal population was subject to bounty or other hunting, it seems to have been fairly stable in size. Since the cessation of hunting it has been increasing steadily, possibly by as much as 10% per year. There is no direct evidence to suggest that the rate of increase is yet slowing down, although it obviously cannot continue indefinitely.

Practical Aspects of Population Control

Costs

The costs of culling operations will depend on the strategy to be employed. They will be least, per seal killed, when several hunters can travel together and kill seals which are concentrated in large numbers on a limited area of land, such as breeding colonies on islands. Most of the major operations which have been undertaken by the Department of Fisheries and Oceans, such as those against Steller sea lion rookeries in British Columbia, and against grey seals in the Maritimes, would fall into this category. Strategies which reduced the number of seals a hunter could kill in a day and increased the distance he had to travel between kills would be more expensive, possibly by a large amount. Operations spread over a wide area and aimed at killing seals on their feeding grounds would fall into this category; they might be considered in order to provide representative samples for scientific purposes. They might also be more acceptable to public opinion.

The Task Force on Seal Borne Parasites (Canada, DFO, 1983) proposed a series of options for the culling of grey seals. The suggested numbers ranged from 17,000 (believed to be the maximum possible) down to 8,600, with 50%–60% comprised of pups. This is roughly five to 10 times the recent average level of kill. These operations were apparently to be carried out in

the same manner (by concentrated killing in the breeding areas) as past DFO operations, and the estimated costs ranged from \$30,000 to \$72,500. The Committee on Seals and Sealing (COSS) pointed out, however, that these figures did not include the salaries of the hunters and other overheads, and suggested that a further \$50,000–\$100,000 would be required (Ronald, 1983a). If these figures are accepted as having at least indicative value, the cost of such a major grey seal cull would be about \$80,000–\$170,000, which appears to be of the order of \$10 per seal killed.

Culling operations, up to the present, have generally been directed at concentrations of seals on breeding grounds, for example, where it is possible for a few men to kill a large number of seals in a relatively short time. This is a strategy that will tend to minimize the cost per seal killed. If it were considered desirable to undertake more diffuse operations in order, say, to obtain a more representative sample of the population for use in scientific studies, the number of seals killed per man per day could be substantially lower, and costs per seal killed could rise accordingly.

The basic cost of a bounty program is the cost of the bounties themselves, but to this should be added the costs of publicity programs, supervision, handling of payments, and so forth. Since 1979, the bounty paid on grey seals has been \$50 for an adult and \$25 for a juvenile. The average basic cost appears to be in the vicinity of \$20,000–\$30,000 for the 720 animals killed. At this level of bounty, the cost per seal killed appears to be more than twice that for an organized cull. This should not be surprising. Culls are generally carried out at the least possible cost. Bounty rewards must be set high enough to cover costs of the operation and leave enough profit to attract fishermen and others to go "bounty hunting."

The Task Force on Seal Borne Parasites (Canada, DFO, 1983) also pointed out however, that the numbers of seals killed under the bounty scheme had been diminishing; it therefore proposed that the bounty should be increased to \$100 per adult seal and \$50 per juvenile. This increase would make bounty hunting considerably more expensive per seal killed than culling, perhaps by four to six times. Any additional rewards for research material, like the rewards of \$50 and \$12 respectively now paid for brands and tags on harbour seals, would add to the costs.

Allowing fishermen to kill "nuisance seals" is, of course, a much cheaper option.

Humaneness

The great majority of the animals killed in past control programs have been shot, although some pups were clubbed. The question of the humaneness of these operations is discussed in some detail in Chapter 20.

The clubbing of grey seal pups can apparently be acceptably humane provided that it is done in a proper manner. In organized hunts under the control of DFO officers, it should be possible to achieve this standard, although the Royal Commission has not received any reports by independent observers on the standards of recent practices. The Commission has not, in fact, been informed of the respective proportions of grey seal pups that are clubbed and shot. It has, however, been told that although in the past Steller sea lion pups have been killed by clubbing, this method of killing is not easy to use effectively because of the thickness of both the skull and the hide (Bigg, 1985b). Any killing of these pups should therefore be done by shooting.

The humaneness of shooting operations depends primarily on obtaining the maximum proportion of quick kills, that is, animals are either killed instantly or, if wounded, despatched rapidly thereafter. There appear to be considerable differences among past control operations in this respect.

The accuracy, and therefore the humaneness, of shooting depends greatly on whether the shooter is on a stable base, and whether the seals are on land or in the water. Moreover, when seals are shot in the water, wounded animals may submerge and either escape or die slowly.

Whatever the kind of seal and the hunting technique, much depends on the care and skill of the hunter, and for this reason organized hunting under DFO control should be preferred to bounty hunting by individual hunters, whether or not they are professional fishermen. In addition, most seals shot for bounties are probably fired at while in the water. The Committee on Seals and Sealing has described bounty hunting as "inefficient, ineffective, and often inhumane" (Ronald, 1983a).

There has been some criticism of the wounding rate in the grey seal cull (Webb, 1984), although this criticism might possibly be overcome by the use of more powerful ammunition or by restricting the killing to pups. The Royal Commission was advised, however, that shooting of adult Steller sea lions is unsatisfactory, both because of the size and tough hides of the animals, and because local conditions require that most shooting be done from boats, which makes accuracy uncertain (Bigg, 1985b).

It was also suggested to the Royal Commission (Bigg, 1985b) that under suitable conditions, harbour seals can be effectively and humanely shot in the water by careful marksmen on land.

It appears, therefore, that acceptable standards of humaneness could, with adequate supervision, generally be achieved in population-control operations involving the kill of grey seal pups (either by shooting or clubbing), Steller sea lion pups (by shooting), and harbour seals (by shooting). In all cases, however, the operations should be undertaken by trained and responsible people and be under DFO supervision.

The Royal Commission realizes that although the killing of pups in culling operations is more likely to be humane than is the killing of adults, it is also more likely to cause an adverse public reaction. This would be particularly true if the pups were to be killed by clubbing.

Control Operations as a Source of Data

Any management program, to be effective, must be based on knowledge of what is being done. It is therefore important to know what numbers of seals are killed in any control operations and, preferably, the numbers of pups and adults, and the numbers of males and females. The information obtained from supervised hunting is generally better than that from bounty hunting, and better still than that from permit operations. There will always be an unknown loss rate, but DFO considers it will be lower in culling of grey seals than in bounty hunting, both because culling is a directed activity and because only high-powered rifles are used (Canada, DFO, 1985, p. 83). The Royal Commission believes that this view is correct; it also seems probable, in the Commission's view, that a more reliable estimate of the rate of loss can be obtained in culling operations carried out under direction, than in bounty or permit hunting. The Task Force on Seal Borne Parasites (Canada, DFO, 1983) stated that fishermen estimated the loss rate in bounty hunting of grey seals at 25%; Mansfield and Beck (1977) estimated loss rates at 76% in spring and early summer, and 50% in late summer and fall. For harbour seals Bigg (1969) estimated the loss rate at 50%.

The Department of Fisheries and Oceans in its brief states that the bounty program was of value in providing a random sample of the seal population, which can be used to determine its age structure; this information is vital to population assessment (Canada, DFO, 1985). This may be so because the portion of the animal required for payment of the bounty is the jaw, which contains teeth from which the age of the animal can be determined.

No studies seem to have been undertaken to determine whether or not there are, in fact, any biases in the sample of population obtained by bounties. The present culling procedure for grey seals, taking mainly pups and some breeding females, does not provide a random sample of the population. It would seem possible, however, to devote part of the supervised effort to the taking of random samples of the population by trained hunters, as Fisher (1952) advocated for harbour seals on the west coast. This practice would greatly increase the value of the information obtained for scientific purposes such as monitoring the status of the stock. Cull programs, if suitably designed, could also provide very useful information on feeding and on the incidence of parasites.

Methods of Control

Up to the present, seal control has been carried out in Canada only by killing a certain number of animals. The killing techniques have consisted almost entirely of shooting and clubbing. The merits and demerits of these methods have been discussed briefly earlier in this chapter and more fully in Chapter 20. In theory, at least, other killing methods are possible, and it might also be possible to reduce seal numbers, at least at critical times and places, by methods other than killing.

Other Methods of Killing

Although several alternatives to the existing methods of killing seals are theoretically possible, none appears at present to be acceptable. Both netting and poisoning could be effective, but for reasons discussed in Chapter 20, they would both be unacceptable on the grounds of humaneness.

Fisher (1952) describes what was apparently a successful attempt to kill a substantial number of harbour seals by using dynamite to blow up the sandbar on which they were resting. He suggests that this technique could be effective elsewhere where it is impossible to approach closely enough to kill the seals in other ways. As described the method is probably quite humane, since the seals were "blown to pieces." The Commissioners doubt, however, whether such a procedure would gain public acceptance at the present time.

Biological control of undesirable mammalian populations has been applied with considerable success in some cases, such as that of rabbits and myxomatosis in Australia and the United Kingdom. Apart from the techni-

cal problems of finding an appropriate pathogen if, indeed, one exists, an attempt to apply this method to seals would be open both to strong humanitarian objections and to the objection that even if some animals were killed, it would be impossible to regulate the resulting population level; on the one hand, the reduction in population might be uselessly small, or, on the other hand, excessive. The adoption of such a proposal cannot, therefore, be recommended.

Methods of Reducing the Impact without Killing Seals

The Task Force on Seal Borne Parasites (Canada, DFO, 1983) discussed the possibility of checking reproduction of seals by administering anti-fertility drugs to breeding females; this suggestion followed some preliminary biochemical studies carried out by Ronald (1983b). The Task Force considered, however, that "the logistics of administering [the drug] to most adult females are almost impossible." It also pointed out that such a technique, even if successful, would bring about only a gradual decline in the population. It therefore did not recommend further exploration of this approach, and the Royal Commission would concur with this view.

Local reduction in numbers through dispersing seals, as distinct from reducing the size of the whole population, might be beneficial in reducing losses from damage to gear and damage to or loss of fish caught by the gear. The development of scaring devices for this purpose seems to show some promise; it is discussed briefly in Chapter 25. So far as the Royal Commission was informed no such research is being undertaken for seals in Canada at present, and the Commissioners believe that favourable consideration should be given to well-conceived research on these lines.

One possibility of achieving a long-term reduction in numbers of seals while avoiding large-scale killing of animals may be through a continuing program of disturbance of breeding colonies at the critical time of, say, parturition and mating. Such a program would aim at achieving a substantial reduction in the number of pups produced. It seems most likely to offer chances of success for strongly colonial breeders like grey seals and sea lions. Some Steller sea lion rookeries on the coast of British Columbia have disappeared since 1913 (e.g., Virgin and Pearl Rocks; Bigg, 1985a) following large culling operations. It is not clear from the limited records available how much the actual killing contributed to the seals' disappearance, and how much was attributable to disturbance of the survivors. Observations on grey seal colonies in the United Kingdom have suggested the possibility of

developing such a technique (Summers and Harwood, 1978). A program of this kind might provoke substantial public opposition, however, if it led to females abandoning their pups in any numbers, with the subsequent deaths of pups by starvation.

Further possibilities which might merit consideration would be making breeding areas less usable by such means as changing the nature of the surface or fencing off particularly suitable areas.

Organizational Arrangements

Table 29.1 attempts to summarize the main features of the principal ways in which government-approved seal hunting could be carried on to provide population control. The methods of organizing are largely self-explanatory. Killing by government employees or contractors has been divided into two broad operational forms. The first, killing on breeding grounds, as for example, the culling of grey seals on the Atlantic coast and of Steller sea lions on the Pacific coast, enables large numbers of seals to be killed in a short time, but the concentrations attacked are usually not representative of the whole population. The second, large-scale operations by government-employed hunters covering wide areas, have not been used in Canada, but they could, as discussed earlier, be organized to provide truly representative samples. Such a scheme was suggested by the Task Force on Seal Borne Parasites (Canada, DFO, 1983), and Fisher (1952) proposed a rather similar arrangement for the control of harbour seals in B.C. waters.

A distinction is made in Table 29.1 between arrangements which are laid down for fishermen to kill seals under permit, and arrangements under which permits may be given to hunters generally. The reason is that under the first system, a large proportion of the kill will tend, whether officially or not, to be "nuisance" seals, and their removal should produce a greater reduction of loss caused by damage to gear and loss of catch than would killing the same number of seals in a widespread operation. Licensing other hunters might produce a more diversified kill.

Marketing of Products from Control Operations

If any programs are adopted for killing substantial numbers of seals in order to control the size of the population, every effort should be made to salvage the pelts and, if possible, the carcasses and put them to good use. There are a number of reasons why this should be done.

Table 29.1
Main Features of the Principal Methods of Organizing Population-Control Operations

		Achieve Desired Kill ^a	Limit to Kill ^b	Knowledge of Number Killed ^c	Biological Samples ^d	Humaneness ^e	Cost to Government ^f
Government Employees or Contractors	on breeding grounds	Y	Y	Y	YN	A	H
	representative kill	Y	Y	Y	YR	A	VH
Bounty Hunters		N	Y*	U	YR	B	VH
Fishermen (permit)		N	Y*	P	N	B	L
Other Hunters (permit)		N	Y*	P	N	B	L
General Public (uncontrolled)		N	N	N	N	C	VL
Commercial Hunters (permit)		Y	Y	Y	S	A	M

- a. Achieve desired kill: Y = can kill desired number provided they are available and sufficient staff and funds are used.
N = no effective way of bringing number killed to a target level.
- b. Limit to kill: Y = can regulate kill close to permitted level.
Y* = can regulate kill by closing when target achieved provided there is an adequate reporting system.
N = no effective way of limiting number killed.
- c. Knowledge of number killed: Y = fairly accurate figures on numbers killed should be available.
U = number of bounties claimed is accurately known but this underestimates the kill by an unknown amount.
P = permit holders may be required to provide records of numbers killed but reliability is always uncertain.
N = estimates of kill require special studies.
- d. Biological samples: YR = can obtain samples from kill which may be usefully representative of population.
YN = can obtain samples which are only representative of animals killed.
N = cannot easily obtain samples.
S = can obtain samples by employment of sampling staff.
- e. Humaneness: A, B, C = in approximate order of decreasing acceptability.
- f. Cost to government VH, H, M, L, VL = in approximate order of decreasing cost per seal killed.

- The waste of potentially useful material is ethically undesirable.
- Failure to utilize the remains would provoke adverse public reaction.
- Large numbers of carcasses, if left to rot would be a source of environmental pollution. Burying might also cause environmental disturbance.
- Use of the pelts and carcasses might offset some of the financial costs of the operations, although the labour and transport costs could equal or exceed the value of the pelts or carcasses retrieved (Canada, DFO, 1983).

The Department of Fisheries and Oceans has advised the Royal Commission that it did try, at one time, to arrange for the pelts of grey seal pups killed to be salvaged and marketed. This attempt was unsuccessful, chiefly because the number of pelts available (about 1000) was apparently much too small to make it economically advantageous for the processing company to send a vessel to collect them. This might suggest, at first thought, that salvaging the skins might be worthwhile in a large-scale operation. A number of factors would be involved, however, in this decision. Among these are the following:

- Skins from some localities, such as Sable Island, contain sand which might damage the processing machines.
- Only skins of grey seals pups can be utilized because those of the adults are too badly scarred.
- Ships sent to collect skins could not get close to Sable Island.
- There would be some additional supervision and handling costs to DFO.

Harbour seal pelts from the west coast were marketed successfully for a time in Europe in the 1960s, but the price apparently collapsed. Whether it would be possible to find a market again, if significant population control operations are considered in the future, seems doubtful, but the effort should be made.

Summary

Considerations put forward in the preceding sections lead to the conclusion that if population-control operations are to be undertaken in

the future, the following essential features should be considered:

- Operations should be under close government control and should normally be carried out by government employees. The purposes of this arrangement are to ensure that
 - the maximum possible degree of humaneness is observed;
 - numbers of seals killed and location of operations are in accordance with plans;
 - proper records are kept of all operations and required biological material is collected.
- Costs will generally be lowest if operations are concentrated on breeding colonies, but such operations will not provide representative samples for population assessment and monitoring. It will be important to take the requirement for information into account in developing overall plans.
- If pups are to be killed, it is likely that clubbing would be a humane method by objective standards except for Steller sea lions. Nevertheless it must be recognized that clubbing creates a repulsive visual image and at present arouses very strong public opposition. This might imply that killing of pups should not be included in a culling program, though use of alternative methods of killing pups (e.g., shooting, perhaps with the Hughes pistol; Hughes, 1985) could also be considered.
- Where seals are creating serious local losses (e.g., damage to fish traps and pounds), and these losses cannot reasonably be prevented by driving seals away or use of government hunters, fishermen might be allowed to kill seals under special conditions, namely that
 - numbers killed are strictly limited and proper records are kept;
 - only acceptably humane killing methods are allowed;
 - collection of biological material useful to population monitoring is required; payment should be realistically related to the time involved.
- If possible the seal products obtainable from seal-culling operations should be used in a non-trivial way.

- Consideration should be given to other means of reducing the productivity of breeding colonies.

Economic Justifications for Population Control

Proposals for programs to limit or reduce seal populations are almost invariably based on the desire to control economic losses to the fishing industry caused by one or more of:

- heavy incidence of nematode parasites in fish;
- direct damage by seals to fishing gear and catches;
- reduction in the abundance of commercial fish by seal predation.

Development of population-control policy involves a decision on whether and by how much to reduce the number of seals or possibly to limit the growth of the seal population by natural increase. Such a decision can be approached in two ways: either in absolute terms by aiming to move the population to, or towards, an identified optimum level, or on a directional basis by seeking to change the population by a certain amount from its current level towards one producing smaller losses or by limiting adverse changes that would otherwise occur.

The first approach involves identifying an optimum, or at least a desirable, level for the seal population. The problems in defining such a level are examined in Chapter 27 with particular reference to the management of the harvesting of economically valuable resources.

The conceptual difficulties stem from the fact that the optimum population level depends on the weight given to the various benefits and costs derived from the seal population. It has been shown in Chapter 27 that a useful reference level in identifying the optimum is provided by the maximum sustainable yield (MSY). If any benefits, in addition to the yield, increase in some way with the numbers of seals, they will tend to move the optimum above the MSY level; intrinsic values attached to living seals in the ocean, and reduction of harvesting costs as seals increase are both examples of such benefits. On the other hand, if there are costs which increase with the seal population, they will tend to force the optimum below the MSY level. The sources of loss that are listed above would fall into this category. It appears very doubtful that it is possible to base population-control strategies

on bringing populations to optimum levels, except in very broad general terms, given the difficulty of achieving an appropriate conceptual balance for any particular population, then determining the population size that meets this balance, either in absolute terms or relative to the unexploited level, and finally estimating the actual population size accurately enough to relate it to the theoretical optimum. It was precisely these difficulties that brought about the practical failure of the International Whaling Commission's New Management Procedure. It may not be feasible to adopt more definite guidelines for a desirable population level in absolute terms than to ensure that the population can continue to meet the three explicit objectives of the World Conservation Strategy, as given in Chapter 27. These objectives, however, do not take into account the further, though rather intangible, benefits which a significant part of the public receives from knowing about, or actually seeing, large numbers of seals swimming in the oceans. It may be possible to quantify some part of these benefits in economic terms such as gain to be made from organized "seal watching" (see Chapter 17), but the Royal Commission has not seen any useful information bearing on the evaluation of these "benefits" in total.

The directional approach to the development of population-control policy seems to offer considerably more hope of success, particularly if the principles discussed above are used to define a lower limit below which the population should not be reduced. In this circumstance guidance could be obtained by trying to compare the benefits to be gained by reducing the population (or preventing its increase) with the costs of the operation. As a first step a direct comparison of costs and economically measurable benefits might be attempted, but it should be borne in mind that social and ethical costs might also be involved.

The small amount of data available to us on the cost of culling operations has been reviewed earlier in this chapter. It appears that the costs of past and proposed operations have been in the range of \$10-\$100 per seal killed. Much depends on the volume of the operations, and considerably higher costs could be incurred if hunting were carried out on a more diffuse basis rather than concentrated on breeding grounds.

The social or ethical costs of a culling operation have at least two components. One derives from the reduction in the numbers of seals; this is the inverse of the benefit discussed above. The other category of social and ethical costs covers those associated with the actual killing of the seals. These costs derive primarily from the distress caused to some people by the thought that the animals are being killed; their extent might depend on such factors as the age of the animals and the method by which they are killed.

There might also be direct economic costs arising from steps to keep the public fully informed about the cull and the reasons why it is being undertaken or, where relevant, the reasons why a cull is not being undertaken.

Relation between Seal Numbers and Costs to the Industry

Elsewhere in this Report (Chapters 24, 25 and 26) the Commissioners have examined, as far as the data allow, the extent of losses caused by seals under present conditions. The principal questions are the following:

- What would be the reduction in the losses incurred in replacing and repairing fishing gear if no seal ever became entangled in a gill net or other fishing gear?
- What would be the reduction in the processing costs if no cod or flatfish contained seal-borne parasites?
- What would be the increase in fish catches if no seal ate a commercially valuable species of fish?

In a strict sense these are meaningless questions, since no one is proposing the elimination of all seals, even if such a course were practicable. Nevertheless, they provide a useful way of approaching the more meaningful questions about the changes in the costs or income of fisheries that might occur if there were changes in the seal population.

These are not easy questions to answer, and it will be helpful to address them in two stages: first, to estimate the average impact per seal, obtained for each significant species by dividing the total impact, as estimated in Chapters 24, 25 and 26, by the total number of seals of that species; and secondly, to consider how this average impact might differ from the rate at which the impact on the fishing industry will change if the seal population changes, as a result, for example, of a culling program or a cessation of commercial hunting.

Average Costs per Seal

Table 29.2 develops indicative estimates of the average losses per seal for those species believed to affect the Atlantic fisheries most significantly. The first lines of the table show estimates of the present annual loss per spe-

Table 29.2
Indicative Average Annual Costs per Seal

	Harp Seals	Grey Seals	Harbour Seals
Annual Costs (\$ million)			
Parasites % (% of \$30 million)	1% 0.3	98% 29	1% 0.3
Damage % (% of \$2 million)	5% 0.1	80% 1.6	15% 0.3
Competition for Fish	<u>23-75</u>	<u>30-84</u>	<u>1.6-3.7</u>
Total Cost	23-75	61-115	2.2-4.3
Population	2×10^6	70×10^3	13×10^3
Annual Cost/Seal (\$)	12-38	900-1600	170-330

cies per source; the estimates relating to parasites and gear damage have been obtained by distributing the total losses for each source according to a possible percentage schedule. The percentages for parasites have been derived from Table 26.5 in Chapter 26, using the estimated numbers of adult female parasites in each species of seal and the most recent seal population estimates. The percentage allocations for damage to gear are hypothetical, but they are consistent with the comments in Chapter 25 on the relative amounts of damage caused by the various species. The estimates of the competition losses deriving from each species of seal have been taken from Table 24.13 in Chapter 24. The total losses caused by each species are obtained by adding the estimates for each source. The totals are then divided by the estimated populations given in Chapter 21, to obtain the annual loss caused per seal.

The figures arrived at can only be regarded as very approximate, but they do give a useful indication of at least the order of magnitude of the average impact per seal on the fishery. It is evident that the effects are substantial for grey and, to a lesser extent, for harbour seals, but much smaller for harp seals.

How Costs Change with Seal Numbers

The ideal basis for further discussion would be a curve for each species relating the numbers or abundance of seals to their impact on fisheries. In practice only two points on the curve can be identified, and even these have a considerable degree of uncertainty. These points represent the present position, and, with reservations, the origin: no seals, no impact. The reservations about the origin arise because, while the effects of gear damage and competition will fall to zero if there are no seals, there may, in the absence of seals, still be some losses in handling fish infected with nematode parasites, which might be transmitted through other kinds of animals. This effect, however, is believed to be small.

The simplest assumption is that of proportionality: that the impact is proportional to the number of seals so that average impact is constant. This assumption is unlikely to be strictly correct, but the probability of, and the extent of departure from, proportionality will be different for different types of impact.

At this point, it will be useful to distinguish between the average cost per seal, the marginal cost, and the average cost per seal of a given change in population level. The first has been discussed above. The marginal cost is the change which would occur in the total losses if the seal population were changed by one seal. It is equivalent to the slope of the curve of cost versus seal population at the given population level, and may therefore change with the population level if the relation is not proportional. It is the appropriate form of cost per seal to use if the strategy under consideration is maintenance of the seal population at the current level. The average cost per seal for a given change is the appropriate form to consider if the proposal under review is to change the population from the present to a new, and probably lower, level. It is represented by the slope of the straight line joining the corresponding two points on the loss versus seal-population curve. If this curve flattens off towards the top, this cost will be lower than the average cost and will, in general, tend to approach it as the target population level is reduced. If the curve is S-shaped, there will be an intermediate population level at which the cost per seal for the change is equal to the current average cost.

The relation between the numbers of seals and the costs to the fishing industry arising from the presence of nematode parasites depends both on the relation between numbers of seals and incidence of worms in the fish, and the relation between incidence of worms and costs to the industry. Both these aspects are examined in Chapter 26, but it is quite impossible at

present to express either relation in other than general terms. In those terms, the incidence of worms will tend to increase with the abundance of seals, and particularly of grey seals, which individually carry many more worms than either harp or harbour seals. This relation seems to hold generally, both between different areas (the incidence of the worm is particularly high, for example, in the southeastern corner of the Gulf close to the breeding area of a large concentration of grey seals) and over time (there has been a very great increase in incidence over the last 35 years on the NE Scotian Shelf, coincidentally with a great increase in grey seals and some increase in harbour seals breeding on Sable Island).

The nature of the relationship between the abundance of parasites and the level of costs associated with the detection and removal of parasites is also discussed in Chapter 26. It is concluded that there is a strong positive correlation, but there is no reliable evidence as to whether or not the rate at which costs increase relative to the increase in parasites tends to slow down at higher levels of seal abundance. There are some theoretical reasons, however, for believing that both the rate of increase of parasites relative to the increase in abundance of seals and the rate of increase in costs relative to the increase in abundance of parasites might tend to slow down at higher levels of abundance. If this is so, the rate of increase in costs for an increase in abundance of seals can be expected to slow down at high levels of seal abundance.

The relationship between numbers of seals and incidence of damage to gear and catches is considered in Chapter 25. Again, there is virtually no quantitative information, and the simple hypothesis of a proportional relation seems the most reasonable. A less than proportional relation might exist in some circumstances. Some Scottish data suggest that only a limited number of seals attack salmon nets, and that this number does not increase with the seal population (see also Northridge, 1983, cited in Northridge, 1986). On the other hand, there is the hypothesis put forward in Chapter 25 that "to the extent that increasing seal abundance could add to their pressure on their food supplies, it might cause the individual seal to be more anxious to take the bait from a lobster pot or fish from other fishing gear, and damage might increase faster than abundance." These observations, however, do not constitute sufficient reason to discard the proportional hypothesis. It seems unlikely, in any case, that the true relation will depart very far from proportionality.

The nature of the relation between the loss in value of the catch caused by competition for fish and the abundance of seals was discussed in Chapter 24, and it was concluded that at least in the initial stages of develop-

ing policy to control seal numbers for the benefit of the fishery, it would be reasonable to assume that a reduction in the seal population would bring about a roughly proportionate reduction in losses.

Long- and Short-Term Strategies

Concern giving rise to proposals for population control may be based either on the view that the population is now too big and causing unacceptable losses, as held by some witnesses regarding grey seals (e.g., Fisheries Association of Newfoundland and Labrador Ltd., 1985), or on the fear that unless action is taken, a population will increase to an undesirable level, as in the case of harp seals, in the view of other witnesses (e.g., Rompkey, 1985). Whatever the objective, strategy has to be based on the fact that a program of culling or other hunting does not differ in its effect on the population from a harvesting program. If the kill is greater than the sustainable yield, the population will be reduced, but a continuing kill equal to the sustainable yield will keep the population constant at a level below the unexploited level. Thus, if the population is considered to be above the desirable level, it may be reduced by a single large kill or by a continuing kill for a number of years at a level greater than the sustainable yield. If the former course is to be followed, as was suggested by the Task Force on Seal Borne Parasites (Canada, DFO, 1983) in proposing culls of 8,600–17,000 grey seals, it is necessary, in order to hold the population at its reduced level, to follow up with periodic heavy kills (which was done, in effect, although probably not by prior planning, for Steller sea lions), or with a continuing kill at about the sustainable yield level for the future. The alternative strategy of gradual reduction of the population by a continuing kill somewhat above the sustainable yield level has the advantages of minimum cost at any one time and of providing opportunities for monitoring progress. Its main disadvantage is an increased delay before the results of the program become apparent. A considerable range of data exists which suggests that for many seals the sustainable yield of an already reduced population is in the vicinity of 10% (say 8%–13%) of the population, although it seems to be lower for east coast harbour seals under present conditions. The precise figure will depend on the kind of seal, the actual population level, the age structure of the kill and other factors.

Comparing Costs and Benefits

Comparison of the monetary benefits obtainable by reducing the seal population to, or holding it at, a particular level with the monetary costs of

killing the numbers of seals required to achieve this level has three components. The first is the relation between the numbers of seals killed annually and any change in the number of seals present. The others are the relation between the changes of numbers of seals and the changes in resulting financial losses to the industry, and the relation between costs of killing and numbers of seals killed. Of the last two factors, the first is complex and very little understood at present; in this Report the average impact per seal will be used as an index of the likely value of the cost per seal of any change, though this value may well be smaller if the proposal accepted is to hold the population constant or to change it only slightly. The second is likely to depend very much on the hunting strategy. For a given strategy the costs will probably be roughly proportional to the number of seals killed, unless it is desired, for example, to kill a large proportion of the annual pup production. Costs per seal killed will probably tend to increase also if a substantial reduction in the size of the population takes place.

The relation between the differences in population level and the numbers of seals killed can be examined by standard population-dynamics methods. In the simplest case static situations in which populations are assumed constant at different levels can be compared. These can be portrayed by means of a sustainable yield curve of the usual type (Figure 29.1a). The number of animals which must be killed annually to maintain the population at a given level is equal to the sustainable yield at that level. In the figure the required kills for stability at population levels P_1 , P_2 , and P_3 will be proportional to the lengths of Y_1P_1 , Y_2P_2 , and Y_3P_3 respectively. The additional benefits to be obtained annually by keeping the population stable at levels P_1 , P_2 , and P_3 , rather than having no kill, would be proportional to the length of KP_1 , KP_2 and KP_3 respectively. Thus the additional benefit per seal killed, as compared to no kill, is given by:

$$B = KP/YP \quad (1)$$

It is obvious that B will increase as the stable population (P) is reduced, whatever the shape of the yield curve. In Figure 29.1b, B is plotted for the yield curve shown in Figure 29.1a with the net recruitment rate at very small population levels ($r_0 - M$ in the common notation) set at 0.1.

In practice, any decision making based on comparisons of the monetary losses caused by seals and the costs of population-control measures would require information, not about alternative stable states, but about alternative courses of action. Such alternatives might, for example, be between holding a seal population at its current level or allowing it to increase naturally, or between holding a population at its current level or reducing it

Figure 29.1
Idealized Population Yield and Benefit-to-Kill Ratio

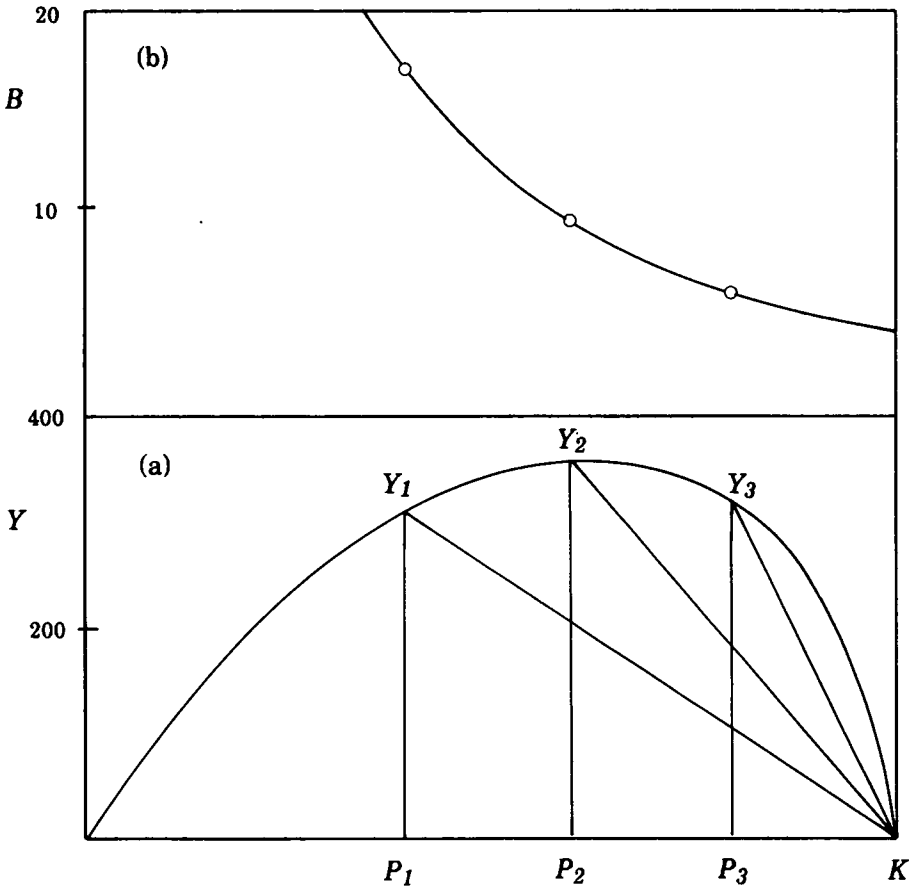


Figure (a). shows sustainable yields (Y_1 , Y_2 , Y_3) obtainable at population levels P_1 , P_2 , P_3 . K is the unexploited level.

Figure (b). shows for the same curve how B (the ratio of annual saving in loss because the population is at P rather than K , to the annual kill required to keep the population at P) varies with P .

to, and then holding it at, a lower level. Such comparisons should take into account not only current losses and costs, but also future losses and costs as the population changes. It is also reasonable that the contribution of future losses and costs should be discounted as the effects become more remote.

Comparisons of this kind are more complex than the stable situations discussed above, but their theoretical basis can still be examined with a relatively simple model. Such a model is developed here.

Development of a Model

The factors which have to be taken into account are:

- (a) The total annual losses increase with the numbers of seals. In the preliminary model, the relation is assumed to be proportional, but extension to allow for other relationships between seal numbers and annual loss is discussed later. The unit of loss is the loss caused by one seal in one year.
- (b) The unit of cost is the cost of killing one seal.
- (c) Seal populations tend to increase towards a maximum. The relation between the rate of increase and the population size can be described by the following function, which has been used extensively in other work on marine mammals, especially whales (Allen, 1980):

$$r = (r_0 - M)[1 - (N/K)^n] + M ,$$

where N = current population size,
 K = equilibrium population size,
 r = gross recruitment rate,
 r_0 = recruitment rate at very small population size,
 M = natural mortality rate,
 $(r_0 - M)$ = net recruitment rate at very small population size,
 n = a constant which determines the MSY level
 (e.g., for MSY = 60% of equilibrium population, $n = 2.4$
 and for MSY = 80% of equilibrium population, $n = 11.2$)

- (d) Future losses and future costs of killing seals should both be discounted; it is assumed to be appropriate to use the same discount

rate for both. Consequently the present values of future losses and costs become negligible after a certain time in the future.

- (e) If a population is to be kept stable the number of animals to be killed each year must be equal to the natural increase in the population; and that number is given by:

$$H = N(r - M)$$

The basic equations which arise from this model are:

Population in year $t + 1$ in the absence of any kill:

$$N_{t+1} = N_t \{1 + (r_0 - M) [1 - (N/K)^n]\} \quad (2)$$

Number of animals killed in year t to keep population constant:

$$H_t = N_t(r_0 - M[1 - (N/K)^n]) \quad (3)$$

Discounted total number of seal years in the future:

$$C = \sum_0^{\infty} N_t(1 - d)^t \quad (4)$$

where d is the discount rate.

Discounted total number of animals killed in the future:

$$D = \sum_0^{\infty} H_t(1 - d)^t \quad (5)$$

Ratio of discounted seal-years to discounted kills:

$$B = C/D \quad (6)$$

Note that B used in equation (6) is not exactly the same as the B used in equation (1), although both compare the losses saved by killing a seal with the cost of killing a seal. In equation (1), B is simply the ratio between the average loss per seal and the average cost of killing a seal. In equation (6), B makes the same comparison, but for a specific culling program; it is the ratio of the long-term discounted losses which would be saved by killing one seal annually as part of this program with the long-term discounted costs of

killing one seal a year. Since the effective comparison is the same, the same symbol (B) is used in the two cases.

The equation in paragraph (c), above, which models the relationship between recruitment rate and seal population size, is a generalized version of the so-called "logistic equation", which is widely used in studies of the population dynamics of marine animals. It is not likely that it exactly fits the actual relationship for any particular seal population, and, in any case, this is, and is likely to remain, impossible to test. Nevertheless, it provides a smooth curve for the relation between sustainable yield and population level which can easily be adjusted to give an MSY at any desired level above 37% of the unexploited level; it is generally accepted that MSY levels for marine mammals are most unlikely to be below this value. The equation also has the advantage of being easily used as a basis for calculations in population models. It would be perfectly possible to use other mathematical formulations to model this relationship, but it must be realized that if they provided a domed sustainable yield curve with an MSY level in the upper part of the population-size range, as seems to be necessary to fit the seal situation, they would, for that reason, lead to rather similar final results if used in the model developed here.

Holding the Population Constant

This model is the simplest case to consider. Here we assume that the two strategies to be compared are to have no cull, thus allowing the population to increase indefinitely until it reaches the equilibrium level, or taking enough seals each year to hold the population constant. Under the first strategy, the relevant losses form the difference between the value of C in equation (4) when the population is allowed to increase and the value of C if the population remains steady. The comparable discounted total of kills is given by D in equation (5) when N is kept constant at the initial level.

The following table shows the values of B , the ratios of seal-years to kills, for various values of the key parameters. The values selected are chosen to cover the likely range of the various parameters. Comparison of lines 1, 2, 3 shows B varying between 7.1 and 4.3 for discount rates between 5% and 15%. Lines 2 and 7 show B at 5.5 and 7.0 when the net recruitment rate varies between 0.13 and 0.08. Lines 2 and 8 show variation in B between 5.5 and 5.3 as the MSY level varies between 60% and 80% of equilibrium level.

Population Control

	Net Recruitment Rate	MSY level (%)	Discount Rate (%)	Pop/ Eqm. Level	Discounted Loss (seal-years)	Discounted Kills	<i>B</i>
1.	0.13	60	5	0.5	7.11	1.05	7.1
2.	0.13	60	10	0.5	2.89	0.53	5.5
3.	0.13	60	15	0.5	1.51	0.35	4.3
4.	0.13	60	10	0.7	1.96	0.52	3.7
5.	0.13	60	10	0.9	0.68	0.26	2.6
6.	0.13	60	10	0.3	3.26	0.37	8.9
7.	0.08	60	10	0.5	2.26	0.32	7.0
8.	0.13	80	10	0.5	3.45	0.65	5.3

Lines 5, 4, 2, 6 show *B* increasing as the population level decreases from 2.6 at population level 0.9 to 8.9 at 0.3. The shape of the relation is similar to that in Figure 29.1b. In brief, it may be concluded from these calculations that *B* will decrease with increasing discount rate, increasing population size relative to the unexploited level, and increasing net natural rate of increase. It is relatively insensitive to the MSY population level as a proportion of the unexploited level. It appears that for a middle range of population levels (say, between 0.3 and 0.9 of unexploited level) the value of *B* is likely to be commonly in the range 3 to 9. Although these figures are based on particular mathematical formulations, other models based on relations of the same general form can be expected to give broadly similar results.

These figures mean that for each seal killed, the losses associated with 3 to 9 seal-years will be saved when a population is being held constant. In Table 29.2 the average annual costs, or losses, per seal for the most important Atlantic species were estimated. By multiplying these figures by 3 or 9, and assuming that the marginal impact at the population level under consideration is equal to the overall average impact, the approximate range of savings made in this way per seal killed can be obtained, with the results shown in the following table.

The maximum identified costs of culling seals in the past have been in the vicinity of \$100 per seal, which is of the same order as the following estimates of savings for harp seals. For harbour and, particularly, grey seals, however, the economic losses which would be saved by killing one

Population Control

	Harp Seal	Grey Seal	Harbour Seal
Annual cost (\$)	12-38	900-1,600	170-330
Saving per seal killed (\$)			
B = 3 (i.e., high population and growth rate)	36-114	2,700-4,800	510-990
B = 9 (i.e., low population and growth rate)	118-342	8,100-14,400	1,530-3,970

seal are likely to be considerably greater than any possible monetary costs incurred in killing that seal.

The estimates of the cost per seal discussed above are average costs over all the seals in the population. The relation between overall average cost and either the marginal cost or the average cost per seal of moving between two population levels depends on the shape of the curve relating costs to seal numbers; this was discussed in an earlier section. It is possible, but not demonstrated, that the rate of increase in the loss caused by parasites would tend to slow down as the number of seals increased. Nevertheless, it seems reasonable to assume at this stage that the losses due to damage to gear and catches and to competition for fish stocks are proportional to the numbers of seals; the true relations may, however, depart from proportionality to an unknown extent. In these circumstances, and allowing for the apparent predominance of competitive costs, it appears that marginal costs at present population levels can reasonably be believed not to differ greatly from average costs, but probably to be somewhat smaller.

If the curve does flatten off at about the present population level (i.e., if marginal impact is less than average impact), there must be a part of the curve at smaller population levels where the curve is steeper (i.e., marginal impact exceeds average impact). Thus any argument against a cull, based on the fact that the use of average impacts may overstate the benefits of a small cull, could be balanced by the argument that an effective cull would have to be large enough to bring the population down to a level when marginal impacts are greater.

Reducing the Population

If other strategies are to be considered, such as a strategy to reduce the existing seal population to a lower level and then stabilize it at that level, the above analysis must be extended. The simplest strategy, and the only one which will be considered here, would be to reduce the population to the desired level by a single major operation in one year and then to hold it at that level. In this event the losses which would be saved are those associated with the difference, in future years, of the number of seals that there would have been if the population had continued to expand from its original level, and the number at which the population will now be stabilized. These losses can be discounted and estimated by the model discussed above. The costs of killing would be the full cost of reduction in the initial year, plus the discounted costs of future killing needed to keep the population stable. As an example, these losses and costs of killing have been calculated for a model with: $r_0 - M = 0.13$; MSY level = 60%; discount rate = 10% for several ranges of population change; with the following results.

Initial Population	New Population	Discounted Losses (seal-years)	Discounted Kill	<i>B</i>
1.0	0.5	5.00	0.97	5.1
1.0	0.3	7.00	1.03	6.8
0.9	0.5	4.68	0.87	5.4
0.7	0.3	5.96	0.87	6.8

The range of values of *B* seems to be similar to those values found in examining the population-stabilization strategy.

Effect of Varying the Cost-Population Size Relationship

Although it is not possible to describe with any certainty the shapes of curves relating losses to seal population levels, it will be useful at this point to examine in a little more detail the way in which average costs per seal, marginal costs and costs for a given change vary for different kinds of curves which might represent the loss-seal population relation.

A number of such curves are portrayed in Figure 29.2a; while none of them can be advanced as representing an actual situation, they represent among them some of the general kinds of relations which may exist in practice. In this figure, V is the total annual loss produced by a seal population of size P ; the units are such that P equals 1 for a population at the unexploited equilibrium level, and V equals 1 for the losses produced by a seal population of that size. Curve A represents exact proportionality, curves B and C represent situations in which the marginal cost decreases progressively as the seal population increases, and curves D and E are S-shaped curves in which the marginal cost is highest at some intermediate population level.

In Figure 29.2b the average loss per seal (V/P), calculated from the same functions, is plotted against population size. The curves presented in Figure 29.2a lead to a variety of relations between V/P and population size, ranging from the loss per seal decreasing with population size (B,C), through little or no variation (A,D), to loss per seal increasing with population size (E).

Figure 29.3a shows how the relationship between B and population size (P) varies for each of these curves in the situation where the choice is between holding the population at level P or allowing it to increase naturally to the unexploited level (i.e., no cull). B , as explained earlier, is the ratio between the discounted additional losses (in units of losses caused by one seal in one year) which would be incurred if the population were allowed to increase, and the discounted costs (in units of the costs of killing one seal) of killing enough seals to keep the population at level P . In all instances B increases with decreasing P and, except in the case E, where loss per seal increases with population size, the curves are concave upwards.

Figure 29.3b shows the same relation for the case where the alternative strategies are to leave the population at the unexploited level (i.e., no cull) or to reduce it to, and then hold it at, a target level P . The general shapes of the curves and their relationships to each other are similar to those in Figure 29.3a, except that they are much less steep at lower target-population levels.

Current Problems

This section reviews the seal populations for which control measures have been suggested as desirable by some witnesses, and examines the available estimates of the impact of each population on Canadian fisheries and

Figure 29.2
Theoretical Relationships between Losses Due to Seals and
Population Levels

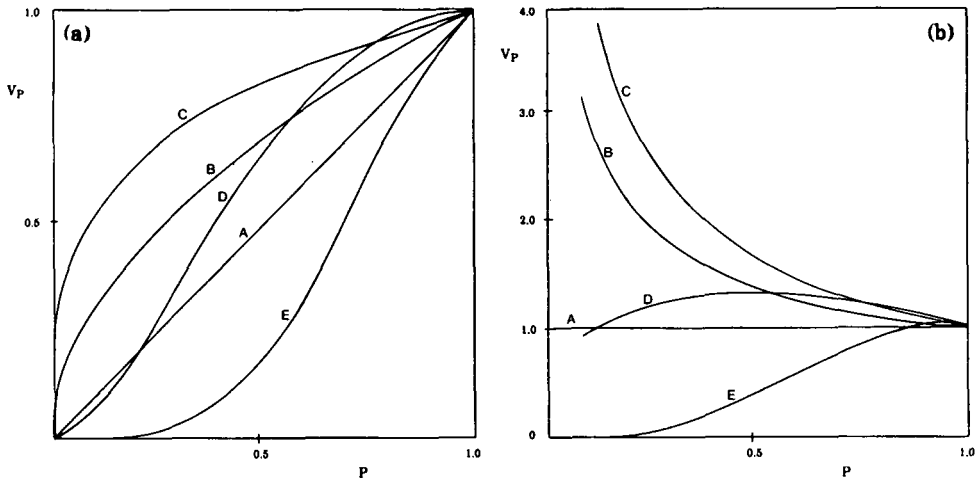


Figure (a). A series of theoretical curves relate the annual loss V_P caused at a relative population level P , to the value of P . P is the ratio of the population to the unexploited level. The relationships of V_P to P are:

- A: $V_P = P$
 B: $V_P = P^{0.5}$
 C: $V_P = P^{0.25}$
 D: $V_P = 17.725P^{1.6725} - 16.725P^{1.7725}$
 E: $V_P = 45.26P^{4.426} - 44.26P^{4.526}$

Figure (b). For each of the above relations of V_P to P , the loss per seal (V_P/P) is plotted against P .

the types and sizes of control programs which would be required to have specified effects on the population.

Past control operations and proposals for future action in submissions to the Royal Commission have dealt only with harp, harbour and grey seals on the Atlantic coast, and harbour seals and sea lions on the Pacific coast. Bearded and ringed seals have little overlap with commercial fisheries; the northern elephant seal occurs only in negligible numbers. The impact of the hooded seal is particularly difficult to assess; its population is large and probably consumes a substantial quantity of demersal fish, but there is uncertainty as to the amount taken from stocks fished by Canada. The northern fur seal seems to have some impact on the herring and salmon fisheries, but its management has until very recently been under the control of the North Pacific Fur Seal Commission, and its numbers are, in any case, decreasing at present. Further, Canadian waters are visited by only one component of the large Pribilof Islands population, and that for only a limited part of the year.

Harp Seal

The impact of the harp seal on the fisheries has not aroused much interest until recently. A number of witnesses, however, told the Royal Commission of their concern about the possible effects of a fairly rapid increase in harp seal numbers if the commercial hunt is not re-established (e.g., Government of Newfoundland and Labrador, 1985; Fisheries Council of Canada, 1985; Fisheries Association of Newfoundland and Labrador Ltd., 1985). This concern relates to all three aspects of the impact of seals on fisheries which have been discussed in this chapter.

The Royal Commission's estimates of the extent of the present losses are set out earlier in this chapter, but it must be stressed again that these estimates are highly uncertain and should be regarded only as indications of what seems to be the likely extent of these effects. The loss resulting from competition between commercial fishermen and harp seals has a particularly high degree of uncertainty. The main competitive effect is almost certainly related to capelin, but it is not clear how much capelin *in toto* is eaten by harp seals, and how much of this total comes from stocks of actual or potential interest to Canadian fishermen. Moreover, because of the erratic history of the capelin fishery, which in some years was prosecuted mainly by non-Canadian fishermen, it is far from clear what would be the effect on Canadian catches of a given consumption.

Figure 29.3
Loss-Population Level Curves for Alternative Culling Strategies

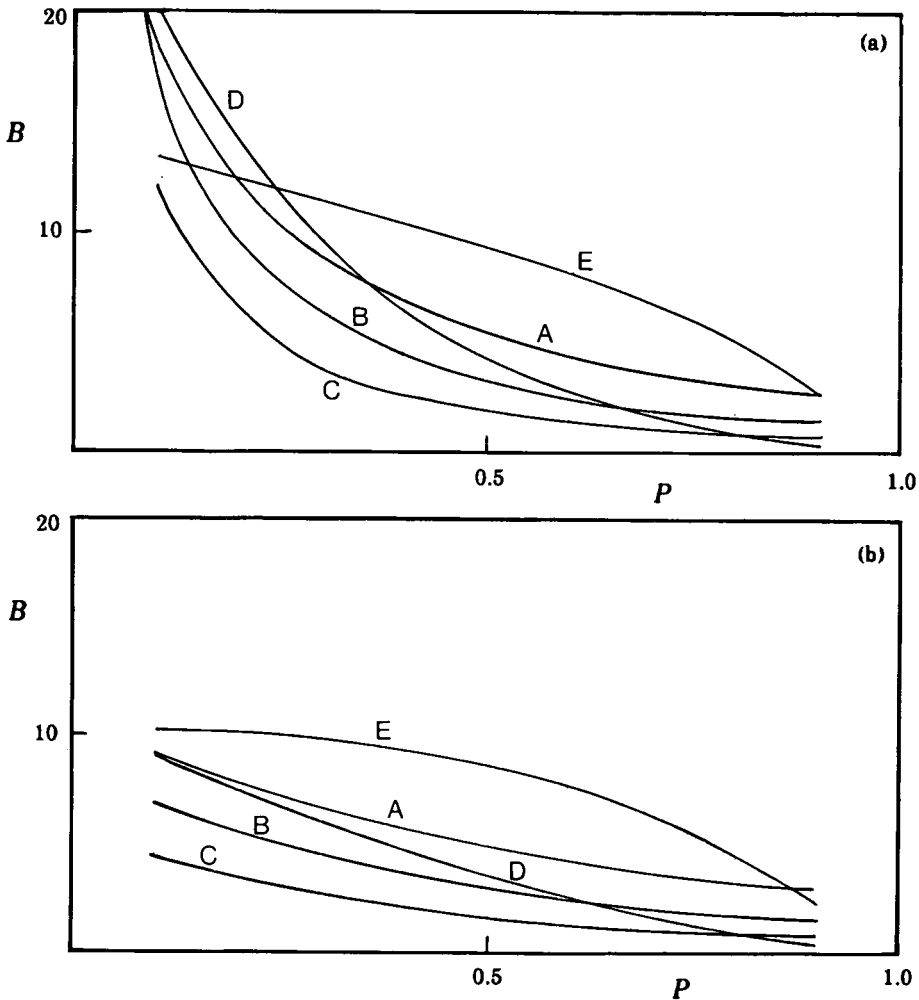


Figure (a). For each of the relations of V_P to P in Figure 29.2a the value of B is plotted in curves (a) against P , where B is the ratio of the additional discounted loss caused by allowing the population to increase naturally from P towards the unexploited level, to the discounted cost of the annual kill required to keep the population at P .

Figure (b). Curves (b) are as above, but with B equal to the ratio of the discounted additional loss if the population is left at the unexploited level, to the discounted cost of reducing it to and holding it at target level P .

If harp seals do increase substantially, some effect would be expected, but whether it would be detectable in the presence of all the other variable factors which affect the catches it is impossible to say. The analysis in Chapter 26 indicates that as far as its effect on the incidence of nematode parasites is concerned, very little knowledge exists at present about the relative potential role of the harp seal to those of the other seals in the southern Gulf. The Royal Commission did not receive any evidence which suggested that harp seals had caused any significant damage to fishing gear and catches until recently. It was told, however (e.g., by Hon. William Rompkey, 1985; Mrs. Alfreda Barker, 1985; and the Wilderness Society of Newfoundland and Labrador, 1985), that in the last two years, presumably as a result of the much greater survival rate of harp seal pups, there had been a noticeable increase in the numbers of young seals becoming entangled in set nets. It is not clear at this stage whether young animals are particularly susceptible to being caught in this way, but if so, this problem may have risen rapidly to a new level with cessation of the hunt, and will only increase further if the breeding stock increases. If animals of all ages are liable to entanglement, the problem will continue to increase, at least for a time, as the more numerous year-classes advance through the population. We have no evidence of the financial losses resulting from damage to nets and loss of catch caused by the entanglement of young harp seals. Table 29.2 gives a rough figure obtained by assigning an arbitrary value of 5% as the share of the total costs of gear damage that is caused by harp seals. It is clear from that table that the true value could differ appreciably from 5% without affecting significantly the total impact, which results mainly from competition.

It is clear from the foregoing consideration that harp seals may present a significant and growing problem to fishermen. The extent of this problem is chiefly the result of the very large numbers of harp seals, and the average damage per seal could be no more than \$12. The marginal benefits per seal killed may therefore be of less value than the costs of killing the seal.

At the same time the average damage per seal might be as high as about \$40. With due allowance for the uncertainties in extrapolating from average damage to the marginal benefits accruing to the fishing industry of killing one seal, it is therefore possible that there could be a significant benefit from killing a seal which would be additional to any direct benefits accruing from the sale of skins and other seal products. If, for example, the marginal impact is no more than 50% of the average impact, and if the factor B is 5, and the average damage is \$40, there will be a net benefit from killing a seal provided that the cost of doing so is less than \$100.

The numbers of harp seals that would have to be killed to be effective in controlling the population are high; a kill of about 170,000 (the level of recent quotas) would be needed to maintain the population close to recent levels. A cull of this extent would almost certainly arouse considerable opposition and might be unacceptable to a large proportion of the Canadian public, especially if it included a significant proportion of pups. The large numbers of seals which would have to be killed in a harp seal cull would also make the operation very expensive.

There are too many uncertainties in these calculations for a cull of harp seals to appear justifiable at the present time. However, the calculations do suggest additional economic considerations which should be taken into account if a reactivated harp seal hunt were to be considered in the future. There are reasonable prospects, too, that further research, especially on the composition of the diet of harp seals, will in a few years reduce appreciably some of the wide limits of uncertainty, and provide a basis for better-informed decisions.

Grey Seal

The arguments presented to the Royal Commission in support of population-control measures concentrated particularly strongly on the grey seal. Table 29.2 indicates that the average impact per seal is very considerable, probably in the range \$900–\$1,600 of which at least half is due to competition. Accepting that at current seal population levels, the marginal impact of transmission of parasites is probably less than the average impact, and that the effect of competition might be a little less than the average, the lower bound of the marginal impact on fisheries due to all causes is probably at least \$500. If it is further suggested, to be conservative, that the grey seal population is not far below its carrying capacity, and if it is recognized that the rate of increase seems to be relatively large, but a moderately low discount rate is taken (which seems reasonable in relation to natural resource management), the ratio B may be quite low, say, 3. This would imply that a lower limit to the economic benefit to the fishing industry of the removal of one seal would amount to \$1,500. The upper limit, using the upper value of the range in Table 29.2, and higher values of B and of the ratio of marginal to average impact, could be \$10,000 or more.

This wide range overstates the degree of uncertainty, since it is highly unlikely that all the quantities about which there is uncertainty are at the lower (or higher) end of their probable range. Even so, the lower bound is much greater than the likely cost of culling one seal.

The Royal Commission therefore believes that the economic benefits accruing from a cull would exceed the cost of the culling operation to an extent that is not known exactly but is certainly very substantial; it therefore considers that on purely biological and economic grounds, a cull of grey seals would be fully justified. The question of whether a cull should, in fact, proceed, taking into account public opinion and other factors, is discussed in the final chapter of this Report.

If a cull is implemented, the numbers of seals that should be killed will depend on the objective of the cull in terms of population size: to maintain the present level, to achieve some decrease, or to allow an increase, but a smaller one than could occur naturally. It will also depend on the dynamics of the grey seal population.

In the simplest case, if the target is to keep the population at the present level, the cull must equal the rate at which the population is increasing in the absence of a cull. The Sable Island population is not subject to a direct cull and is known to be increasing at a rate close to 13% per year. The seals breeding elsewhere have been subject to culls, averaging a kill of 2,000 annually over the period 1976–1983, and it is not clear whether they are increasing or decreasing.

The rate of 13% per year may be the natural rate of increase for Canadian grey seals as a whole, but the rate of increase at Sable Island may differ because of a net migration rate into or out of the Sable Island breeding stock, or because some Sable Island seals have been killed on their migration to other areas. In addition, natural factors may be different at Sable Island and in the Gulf. Compared with what is known about growth rates of seal populations elsewhere, 13% seems a somewhat high figure. If it were the true value, to maintain a population of 70,000 at the current level would require an annual cull of about 9,000 seals; a growth rate of 10%, which would be consistent with a number of other seal populations, would imply an annual cull of about 7,000 seals. The above figures are based on a cull spread evenly through the population, but the actual number that would need to be killed would depend on what ages were taken. If, for example, proportionally more pups were taken, the numbers would have to be increased. Again, as a cull takes effect, the age structure of the population will change, and this, in turn, will change the natural rate of increase and the size of the cull even if the total numbers stay the same.

If it is desired to change the population, the desired change must be added to the cull required to keep the numbers constant. If it is desired, for example, to reduce the population to 70% of its current level in five years

(i.e., from 70,000 to 49,000 or by 4,200 annually), the annual kills (using the figures in the previous paragraph), would initially have to be 13,200–11,200 for each year, but could decline somewhat as the population was reduced, perhaps to about 10,500–9,000.

Harbour Seal

On the Atlantic coast losses caused by harbour seals are much smaller than those caused by grey seals. The number of animals is about one-fifth (Chapter 21), the biomass and the food consumption are about one-fifteenth (Chapter 24) and the effective parasite load about one-hundredth (Chapter 26). The average losses per seal seem to be in the vicinity of one-quarter of those caused by grey seals. Compared with harp seals, the total losses caused by harbour seals seem considerably less; however, because of the very much greater number of harp seals the average loss per seal is probably an order of magnitude greater for harbour seals than for harp seals. Although there are complaints of increasing damage by harbour seals (Canada, DFO, 1985), it does not seem likely that the population is increasing by more than a few percent per year. (See Chapter 21.) The need for any attempt to regulate the numbers of this species therefore seems very slight. The analysis in Chapter 21 suggests that a kill of about 150 pups plus 75 older animals would be sufficient to stabilize the population. The only legal killing at present is by fishermen operating under permit to destroy "nuisance" seals. This arrangement is probably adequate to achieve any control that may be desirable in the short to medium term, although it is important that accurate records of numbers killed should be maintained, and that biological material should be procured from as many animals as possible to enable their age and, if practicable, their sex to be determined. It would also be important for the program and its results to be reviewed regularly.

If such a scheme were adopted, it should be applied only to a limited number of fishermen, who would be allowed to kill defined numbers of seals. It would be important to obtain as much information as possible from such a scheme; fishermen should be required to return detailed records of all seals killed and encouraged to return biological material (e.g., jaws, which can be used to age the seals) which will assist in monitoring the population. A reward for such material might be considered.

On the Pacific coast the position of the harbour seal requires more serious consideration. In Chapter 24 it appeared that about 30%–35% of the loss of herring and about 75%–80% of the loss of salmon were caused by harbour seals. Since the harbour seal was protected in 1970, it has been in-

creasing by about 10%–12% per year, and it is impossible to know how long the increase will continue if not checked. (See Chapter 22.) In these circumstances requests from the industry for control of the numbers of harbour seals are likely to require serious consideration.

In the past a recorded bounty kill of about 3,000 animals a year, plus some unrecorded kills, seems to have held the population stable at about one-third to one-half of the present level. If, however, the population is now increasing at about 10% a year and currently numbers about 45,000–60,000, a kill of 5,000–6,000, in addition to any illegal kills which are now taking place, would be required to keep the number of harbour seals approximately steady. If control were considered desirable, a program of killing, say, 7,000–8,000 seals annually would probably cause a gradual reduction in the population; a scaling down of the kill to 3,000–4,000 as the population was reduced could be expected to stabilize the population at a lower level. In any such program it would be essential to ensure that the number of animals killed was accurately recorded, and that adequate biological material was obtained to enable the structure of the population to be properly monitored. A well-supervised bounty scheme might achieve these results.

However, the most serious problems arising from the presence of harbour seals seem to occur at river mouths and other narrow waters where the seals can feed on migrating salmon and take them from gill nets (Canada, DFO, 1985; Fisher, 1952). Since this is so, an alternative and preferable strategy might be one which killed fewer seals but concentrated on locations where seals were actively attacking the salmon run and interfering with fishing operations. Such a program might not only kill some seals which were taking salmon or attacking gear, but also drive other seals away from the critical area to places where they would do less harm. One way in which it could be executed would be to allow fishermen to kill seals within specified times and areas, preferably under a permit scheme, which could provide better records of kills and could also give rewards for biological material which would assist in monitoring any changes in the structure of the population. Alternatively, control could be carried out by crews of trained hunters employed by the government, as proposed by Fisher (1952). Among the advantages put forward by Fisher for such a scheme are:

- (1) *Control methods could be concentrated at will on spots where they are most needed, for example, in the Fraser, Skeena and Nass Rivers, and in gill-netting areas where the seal problem is acute.*

- (2) *The system should provide much-needed knowledge on numbers, distribution, food-habits and reproduction, through co-operation with biological studies.*
- (3) *The possibility of fraud would be eliminated.*

These advantages seem to carry some weight. Any such program for control by government-employed hunters would have to be undertaken at carefully selected times and places where the destruction would achieve the maximum benefit to the fishing industry. Again, accurate records should be kept of the numbers of seals killed, and as much biological material as possible should be collected from the animals killed. The program should also include regular monitoring to determine its effect on the numbers of seals in the areas concerned.

Steller Sea Lion

Complaints from the fishing industry relating to Steller sea lions mainly concern damage to gear and direct removal of catch from lines and nets; the salmon, halibut and herring fisheries are affected (Canada, DFO, 1985). This species also preys quite heavily on the stocks of salmon and herring. However, the total population on the B.C. coast, including animals from the breeding grounds on Forrester Island in Alaska, is probably about the same as, or possibly somewhat less than, it was in 1956 or at the time of the earliest estimates in 1913. Moreover, the population does not seem to have increased significantly since protection was imposed in 1970. The public impression of an increased abundance in the last few years seems to derive from a combination of an increase in the number of California sea lions visiting southern B.C. waters in the winter and an increase in the number of Steller sea lions migrating into the same area both from Alaska to the north and from Oregon and California to the south, during the same season. The latter move is probably a response to a greater availability of herring in a few recent years.

As noted earlier, the data are not adequate for calculation of either total impact or impact per seal on the Pacific coast. However, examination of the information which is available suggests that much the largest component of the impact of Steller sea lions is likely to arise from their competition for salmon. Any future studies of the problem should therefore pay particular attention to this question.

In these circumstances, the Commissioners do not believe that there is need for any action to reduce the number of Steller sea lions. Current studies aimed at monitoring the numbers of these seals should, however, be continued, and the position should be reconsidered if any significant increase in the overall population is found to be occurring.

California Sea Lion

Only the males of this species have become winter visitors to southern B.C. waters in the last few years. They probably have some impact on the herring fishery in particular, because of the amount they consume and because they get into herring seines and gill nets (Canada, DFO, 1985). Since they probably take a relatively small amount of salmon, the total impact per seal on the fisheries by California sea lions seems likely to be considerably less than that of Steller sea lions. As discussed in Chapter 22, it is not clear why the numbers of this species migrating to southern B.C. waters have recently increased, or whether this trend is likely to continue. Because only a small proportion of the males and no females come so far north, no action in Canadian waters can influence the size of the breeding population. If it were desirable to reduce the numbers in B.C. waters, it would be necessary to kill off each year some proportion of the animals coming up from the south. Unless such an action had some effect in discouraging migration in future years, and this does not seem very likely, the annual kill would have to be continued indefinitely. The number of animals visiting British Columbia has so far been only a few thousand and has actually showed some decrease in 1985. In these circumstances no program for reduction in the number of California sea lions seems to be justifiable, although it will be desirable to continue to monitor the situation closely.

Population Control and Commercial Seal Hunts

The control of seal populations by culls or similar methods is only likely to require serious consideration in the absence of a significant commercial hunt on the seal species concerned. This is because a commercial hunt under appropriate controls could be the most effective method of maintaining a seal stock at a desired level, provided that the kill was large enough to make the hunt economically viable.

The advantages of a commercial hunt over an operation directly implemented by government employees increase as the number of seals to be

taken gets larger. The obvious example is the harp seal. To be effective in maintaining the population either at the present (1986) level, or at some slightly higher level if a moderate increase is held to be more acceptable, the number killed must be close to the present sustainable yield, that is, up to about 150,000–200,000, depending, among other considerations, on the ages of seals killed. A government-operated cull of this size would be extremely costly, almost certainly requiring the expenditure of several million dollars annually.

On the other hand sealers from Newfoundland and elsewhere were taking that number of seals only a few years ago, and most of the men and ships involved still exist and could take comparable numbers in the future. This is probably still true even if no whitecoats were taken, although a limitation to taking older seals would reduce the number of seals which would have to be taken to produce a given effect on the population. The restriction to taking older seals would certainly increase the cost of the operation. The sealers are not now operating on a significant scale, however, because the price they receive for skins is too low.

It may be, therefore, that the most effective way of implementing a cull of harp seals – assuming that it is desired to have a cull of one sort or another – would be through traditional sealing operations on older harp seals, and that the economic viability, and hence the continued existence, of these operations might be achieved by some form of price support for the skins produced. If, for example, there were a guaranteed price for skins of older seals equivalent to that received in 1981, it is likely that many longliners would renew their activities at about the 1981 level. Such a support price would relieve some of the economic and social problems now being felt in many of the main sealing communities. (See Chapter 15.)

The support price needed to reactivate sealing to the level at which it would achieve the desired cull would have to be carefully calculated. It would need to be high enough to generate sufficient interest, but not so high as to give rise to excessive profits or to a level of activity that could constitute a threat to the stock. In any case the number of seals caught should be kept under careful control. Recent history suggests that a gross return of \$20–\$30 a skin for harp seals would be adequate. With present markets this return might need a support payment that would not be much smaller. The data presented in this chapter suggest that the net benefits to the fishing industry per seal killed are likely to be of this order or rather higher. In other words, the costs of the operation would be less than the benefits, and there would be no net drain on the Canadian economy.

No new principle is involved here. Price support is given to the sealers in Greenland, and support, though not in quite the same form, to Norwegian sealers. In Norway at least, a major consideration in supporting sealing is the losses which would accrue to the fisheries if the seals were to increase in the absence of a hunt. In Australia a commercial hunt is encouraged to achieve a cull of the larger species of kangaroos, which compete with sheep and cattle, although no price support is needed.

For a cull to be implemented through a hunt by ordinary sealers, the following conditions would have to apply:

- The total impact of seals on fisheries from all causes combined must be substantial.
- The benefit to fisheries per seal killed must be greater than the cost per seal of the operation, which would be the additional price per skin paid to the sealers over and above the open-market price. Taking account of uncertainties, the requirement, in practice, should be that the additional support per skin be less than the lower limit of the likely benefit per seal killed.
- There should be general public acceptance that the net benefits of such an operation are sufficiently large to justify killing seals. In this context the net benefits should be taken to include any social and economic benefits accruing to the sealers.

Needs for Research

It is clear that if control of seal populations is to be contemplated, either immediately or as part of a long-term strategy, it must be supported by well-planned, comprehensive research programs. It would be particularly important to ensure that control activities are themselves seen as experimental and as major sources of data. Reliable data should be recorded on all aspects of the control activities themselves, including the number, sex, date and location of all animals killed. In addition, the effects of the program should be monitored; this monitoring should cover, in particular, the size, structure and distribution of the seal population, possible changes in its food composition, and the incidence of nematode parasites in key species of fish in the vicinity. This last investigation should take particular account of incidence in the younger age groups of fish.

There is also need to provide a sound basis for the development of population-control programs by means of vigorous continuing research on the underlying problems. These include:

- the size, potential for growth, and factors regulating the seal populations;
- the interactions between the seal populations, and the stocks of commercially important fish and invertebrates and the sizes of commercial catches;
- the relation between the size of the various seal populations and the level of infection of nematode parasites in commercially important fish on a local, as well as an overall, level;
- the relation between the infection rate of parasites in commercially important fish, the operating costs of the processors, and the marketability of fish.

More details on the research programs required are given in the chapters on the individual topics and in Chapter 30.

Summary

1. A number of organizations urged the need to limit or reduce seal numbers in order to minimize costs to the fishing industry caused by reduction of fish stocks by seal predation, damage to fishing gear and catches by seals, and need to remove nematode parasites from fish prior to marketing.
2. A number of other organizations stated in evidence that they were opposed to any control of seal populations, either as a matter of principle, that seals should not be killed to provide economic benefits to the fishing industry, or because impacts of seals on fisheries are not sufficiently well established to justify control measures.
3. Previous control operations have been for:
 - grey seal: culling, 1967–83; bounty, 1976–present.
 - harbour seal:

- east coast; bounty to 1976, since then by permit.
 - west coast; bounty to 1964.
- Steller sea lion: periodic culls on rookeries, 1912-1966.
4. In order to achieve acceptable standards of humaneness, any control operations which may be undertaken should, if possible, be carried out by trained and responsible people, working under DFO supervision. The operations discussed which are most likely to be acceptable in this respect are killing grey seal pups either by clubbing or by shooting, Steller sea lion pups by shooting, and harbour seals by shooting.
 5. Accurate records should be maintained of numbers of animals killed in any control operations, and biological material should be collected to enable changes in the age and sex structure of the population to be monitored. Hunting by government employees should provide the most accurate records of numbers killed. Past culling operations on breeding grounds, such as those for grey seals, provided biological samples which were not representative of the population, since the kill was mainly of pups and mature females. Bounty hunting or properly representative killing by government hunters could be more satisfactory in this respect.
 6. The only species of seals for which the Royal Commission received recommendations for population control were harp, grey and harbour seals, and Steller and California sea lions. The hooded seal has a relatively large biomass and therefore consumes a relatively large amount of food, but it is believed to feed largely outside areas of interest to Canadian fisheries. The northern elephant, ringed and bearded seals have negligible impacts on commercial fisheries. The northern fur seal has some impact on the salmon and herring fisheries, but its numbers are declining at present.
 7. Rough estimates of the total losses caused by each species of seal are given in Chapters 24, 25 and 26, and from these estimates the average impact of an individual seal of each species has been calculated. In the Atlantic these losses ranged from \$40 or less for harp seals and a figure in the low hundreds of dollars for harbour seals to \$900 or more for grey seals. Corresponding figures for the Pacific coast have not been calculated. The average impact is the total amount of losses which would be prevented if all seals were removed divided by the total number of seals. It is not necessarily equal to the reduction in loss that would be achieved if only one seal were removed; this is

called the marginal impact. The marginal impacts may sometimes be less than the average losses per seal, possibly considerably less in the case of losses caused by parasites. If a population were to be reduced, but not totally removed, the average benefit per seal killed would generally be intermediate between the overall average benefit and the marginal benefit.

8. Estimates of the costs per seal killed in control programs have ranged from about \$10 for a large cull of grey seals proposed by the Task Force on Seal Borne Parasites (Canada, DFO, 1983), to \$100 for adult seals killed for the bounty.
9. The effect on the seal population, and therefore on the impact on fisheries resulting from culling a seal, will extend for several years after the seal is killed. The extent of the effect on the seal population will vary with the characteristics of that population, and the effect on the present value of the impact will depend also on the rate at which future losses and costs of killing are discounted. For likely values of population parameters and of the discount rate, the net present value of the benefits per seal killed appear to be about three to nine times the marginal damage caused by one seal.
10. In addition to the economic benefits and costs outlined above, any decision to proceed with a cull must take account of the social costs and values associated with the existence of seals and of the public attitude to possible killing operations.
11. If it is decided to kill seals to maintain the population at some target level, a number equal to the sustainable yield will have to be killed. If it is desired to reduce the population, this reduction will require an additional kill in one year or spread over several years, over and above the numbers killed to keep the population at its current level.
12. No methods of killing other than shooting and clubbing, as practised in the past, seem to be suitable for use in control operations. The possibility of using the pistol proposed by Hughes (1985) for use in the harp seal pup hunt should be considered if there seems to be a strong economic case for controlling harp seal numbers by killing pups. (See Chapter 20.) Further research on means of driving seals away from critical areas should be encouraged.

13. In control operations the advantages of diffuse operations conducted by small teams of highly trained hunters as an alternative to mass killing on breeding grounds should be considered. The advantages include:
 - maintaining the population structure;
 - availability of more representative biological material;
 - less environmental disturbance;
 - the possibility of greater public acceptability.
14. If a major killing operation is carried out, every effort should be made to use carcasses and pelts. This would avoid waste, reduce environmental damage, reduce public reaction and, possibly, reduce the costs of the operation.
15. The marginal impact per harp seal is especially poorly estimated. Because the total numbers of this species are large, the total impact could be considerable. However, the marginal impact per seal could be very small. Although harp seals are increasing in number, the economic justification for an immediate cull of harp seals is, on present evidence, weak. Further evidence could change this conclusion, and more research on food habits, and the extent of parasite infection, is urgently needed.
16. The marginal impact of the grey seal is high, quite likely over a thousand dollars per seal. The benefits from a grey seal cull would almost certainly be several times greater than the costs even if the culling were done in a relatively expensive manner (i.e., on older animals away from the breeding grounds). Grey seals are increasing fairly rapidly, and if no culling is done, the problem perceived by the fishing industry will worsen. There is little information about the public attitude to a cull of grey seals.
17. On the Atlantic coast, the marginal impact of harbour seals is intermediate between that of harp and grey seals. The number of harbour seals is increasing only slowly so the problem is not becoming rapidly worse. On the Pacific coast, harbour seals are increasing rapidly and may have a considerable impact on the herring and salmon fisheries. However, a significant proportion of the damage caused may be attributable to a relatively few seals living near vulnerable

points. These may be better dealt with by means other than a general cull. This may also be true concerning damage by harbour seals on the Atlantic coast.

18. The economic impact of Steller sea lions has not been estimated but, in total, seems likely to be small compared to the impacts of Atlantic coast seals; competition for salmon seems likely to be much the most significant component. The population is probably at a lower level than at some time in the past and is not likely to be increasing. No cull appears justified at present, but population trends should be monitored. California sea lions are only present in B.C. waters for part of the year and probably eat few salmon. No action is justified at present.
19. Decisions on any population-control programs should be based on specific management goals which take account of social and economic values and have been reached by a process of wide consultation. To provide a basis for establishing such programs, vigorous continuing research is required on:
 - population dynamics of seal populations;
 - interactions between seal populations, and the fish stocks and commercial catches;
 - relations between seal populations and the intensity of nematode infections in fish;
 - relations between infection rates of nematode parasites in fish and resulting costs and losses to the fishing industry.

This research would require both continuation of existing programs (e.g., relating to the harp seal population) and establishment of new or substantially expanded programs (e.g., relating to food of seals, relation between seal populations and nematode parasites, and relation between parasite incidence and losses).

20. All population-control programs should be treated as experimental and accompanied by careful monitoring not only of the program itself, but also of the effects on the seal population, its feeding habits, and the incidence of parasites in both seals and fish.

Conclusions

1. Seals cause financial losses to the fishing industry through competition for fish, damage to gear and catches, and contamination of fish with nematode parasites.
2. The species of seals differ considerably in their impact and in how the impact might change in the future.
 - Ringed, bearded, and northern fur seals probably have at most very small impacts.
 - Hooded seals may cause some losses due to competition for fish, but it is possible that their main feeding grounds are too deep and too far north for hooded seals to constitute a serious threat to Canadian fishermen.
 - Harp seals seem to have, at present, an impact only through competition for commercial fish; this impact could be significant. In the absence of a hunt the harp seal stock will increase. The effects due to competition and perhaps also damage to gear or transmission of parasites may possibly increase to the level at which they have serious impacts on the fishery.
 - Grey seals, which are increasing rapidly, are the major source of infection with parasites, and also probably contribute significantly to the losses due to competition, and to gear damage. These impacts are estimated to be between \$60 and 115 million annually. Though far from precise, these estimates are known with greater precision than is the case for harp seals.
 - Harbour seals on the Atlantic coast cause losses that are very small compared with those due to grey seals; in addition, the population is expanding only slowly, if at all. On the Pacific coast harbour seals are increasing quite rapidly, and appear to cause significant losses of herring and salmon. On both coasts damage seems to be localized near seal colonies and areas of fish concentration.
 - Sea lions may have a small impact due to the effects of competition and damage to gear, although some of these losses may be highly visible.

3. These losses could be reduced, or at least prevented from increasing, by reducing or stabilizing seal populations. Based on present information, the only effective method of controlling the numbers of seals is through a cull, though other methods cannot be completely ruled out. For some seals the financial savings from such actions could be several times greater than the costs involved. If the seal stocks are increasing, as is the case for harp and grey seals, there would be disadvantages in postponing a cull if control measures are desirable. The longer a cull is postponed the greater the impacts on fishermen and the larger the numbers that would ultimately have to be killed.
4. In some circumstances the extent of the impact can be reduced without affecting the seal populations. The damage to fixed gears or aquaculture establishments may be reduced if effective methods of scaring seals away from these operations can be developed. It may also be possible to develop cheaper techniques for detecting and removing parasites from fish fillets.
5. There are considerable uncertainties about the magnitudes of many of these impacts, especially in relation to the effects of competition. There are also very large uncertainties concerning the extent of the changes in the impacts, especially the impact of parasites, that would result from changes in the numbers of seals. These changes are unlikely to be exactly proportional.
6. In view of the many uncertainties about the costs and benefits of population control, any such operations should be regarded as experimental and be supported by an expansion of relevant research programs.
7. Operations by government-employed hunters are generally superior to a bounty scheme on the basis of their effectiveness in meeting the objectives of the cull, their better collection of data on the kill, their lower cost and the greater humaneness of controlled operations.
8. Where seals cause serious local losses which cannot be prevented in other ways, consideration should be given to allowing fishermen to kill "nuisance" seals under strict controls.
9. Public attitudes towards killing seals, and regarding the relative values of seals and commercial fisheries, should be taken into account before any decisions on culling are made.

10. The chosen balance between the interests of fishermen and the views of those opposed to any killing of seals needs to be expressed in explicit guidelines for each seal population, determining whether they should be allowed to increase, be reduced or be stabilized.
11. For only four species – harp, grey and harbour seals and Steller sea lions – do current total impacts, or marginal impacts per seal, appear sufficiently large to make it necessary to consider measures of population control.

For harp seals the present marginal impact per seal may be quite small, and might possibly be less than the cost of a government-operated cull. Large numbers would need to be killed for effective control, and there are many uncertainties that might be significantly reduced in a few years if there is an effective research program. A government-operated cull does not appear justified at the present time.

The net economic benefits of a cull of harp seals would be greatest if it were carried out by existing sealers under a program of price supports for sealskins. In addition, such an operation would help to relieve some of the economic and social problems being felt in the traditional sealing areas. A large-scale cull of this kind would, however, almost certainly involve very considerable public protest.

For grey seals the economic benefits of a cull to the fishery would, even on conservative estimates, be several times the likely cost of a cull. Culls of grey seals were carried out in the years up to 1983 without significant public protest. About 7,000 grey seals would need to be killed annually in order to maintain the population at its present abundance. This is more than were killed in the pre-1984 culls. Culls of this magnitude would almost certainly require operations on Sable Island, and these might involve increased public protest.

For harbour seals the total impact is relatively small, and the most serious effects concern limited areas. The problems might be resolved by allowing fishermen to kill "nuisance" seals under strict controls, or by localized government culls.

For Steller sea lions, the damage through attacks on fishing operations tends to be relatively conspicuous; however, the greatest impact on the fishery is probably due to competition for salmon. Losses due to all causes seem to be small compared to those on the Atlantic coast.

The population is probably no greater than in 1913 and is not increasing. There seems to be no technical justification for instituting a cull at this time, although it will be necessary to keep a watch on population trends.

Recommendations

1. The Department of Fisheries and Oceans should, with appropriate advice, establish explicit guidelines for determining which seal populations should, in principle, be allowed to increase, or be reduced or stabilized. No population control activities should be undertaken unless clearly favoured by the balance of social and economic benefits, and then only under a carefully monitored long-term program of evaluating their efficacy.
2. Any population control operations should be done under government supervision.
3. Fishermen operating fixed gears, including aquaculture establishments, may be given licences to kill "nuisance" seals in the vicinity of their gears under strict controls, with provision for a recompense for return of biological material of value to research programs.
4. Any population control programs should be:
 - designed to provide detailed data on such matters as the number, age, sex, location and parasite load of the animals killed, and
 - associated with continuing monitoring of the population concerned to determine any changes in the numbers, structure and principal biological parameters of the population, as well as the efficacy of the population control measures.
5. The government should promote further studies aimed to establish more precisely the impact of seals on fisheries through competition, damage to gear, and transmission of parasites. Particular attention should be given to the relationship between changes in seal numbers and changes in impact, especially in relation to parasites. Research programs should also be undertaken to determine the effects of any control operations, both on the seal populations and on their impacts.

6. Studies should be made of possible methods of controlling the abundance of seals, other than by culling. Studies should also be made of possible methods of reducing impacts other than by a general reduction in seal numbers. These might include seal-scaring devices and improved techniques for detecting and removing parasites.
7. There should not be a cull of harp seals in 1987, but the impact of harp seals on fisheries will increase, and the possibility of a cull in later years must be seriously considered.
8. If a cull of harp seals is found to be biologically and economically desirable and publicly acceptable, consideration should be given to the use, in the implementation of the cull, of ex-sealers from the communities most severely affected by the collapse of the seal markets.
9. The Royal Commission believes that biological and economic considerations indicate that substantial advantages would be gained by a cull of grey seals. Nevertheless, before deciding whether to implement such a cull, the Canadian government should take account of public opinion and should make use of the advisory processes discussed in Chapter 30 for this purpose. Because grey seals are increasing rapidly, a decision needs to be made as soon as practicable.

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Chapter 30

Canadian Management Policies

This section reviews Canada's record of managing seals and sealing and proposes future management policies. Some of the details of past management measures are considered elsewhere. The conservation of harp and hooded seals is described in Chapter 21, the control of possible cruelty in any large seal hunt in Chapter 20, and management of grey and harbour seals and sea lions in Chapter 29. A summary only of relevant measures is included here. The evaluation of past performance pays particular attention to two matters on which there has been criticism: lack of responsiveness and excessive costs.

Past Management Practices: Harp and Hooded Seals

Conservation

Harp and hooded seals migrate between Canada and Greenland. Until Canada introduced its 200-mile limit, much of the harvest was taken outside Canadian jurisdiction. In addition to the seals caught by Canadian sealers, substantial numbers of these animals were taken from both the Front and Gulf herds by Norwegian and other sealers. Significant subsistence hunting also takes place in Greenland.

Under such circumstances, co-ordinated international action was needed to manage the stocks. Until all the member countries of the International Commission for the Northwest Atlantic Fisheries (ICNAF) agreed to give it the power to deal with seals, a concurrence reached in 1966, regulations were largely confined to opening and closing dates. These were implemented by Canada unilaterally, though often after consultation with Norway. Beginning in 1971 quotas have been applied, first by ICNAF and, after the extension of jurisdiction, by Canada, acting on advice from the Northwest Atlantic Fisheries Organization (NAFO). The history of the specific regulations is summarized in Table 30.1 (for harp seals) and Table 30.2 (for hooded seals).

Table 30.1
Highlights of Management Measures Implemented for Harp Seals,
1961-1985

1961	Opening and closing dates established for Gulf and Front areas.
1964	Licensing of sealing vessels and aircraft.
1965	Prohibition on killing of adult seals in breeding or nursery areas; introduction of licensing of sealers, quotas in the Gulf, and regulations defining killing methods.
1966	Ammendments to licensing, extension of Gulf quota areas, rigid definition of killing methods.
1971	TAC for large vessels set at 200,000 animals; allowance of 45,000 for landsmen.
1972	TAC reduced to 150,000 (including estimated catch of 30,000 by landsmen).
1976	TAC reduced to 127,000.
1977	TAC increased to 170,000 (including allowance of 10,000 for northern aboriginal people). Number of adult harp seals restricted to 5% of catch.
1978	TAC increased to 180,000 (including an allowance of 10,000 for northern aboriginal people).
1980	TAC continued at 180,000 (including an allowance of 1,800 identified for the Canadian Arctic and 10,000 for Greenland).
1981	TAC for Canadian waters set at 170,000.
1982	TAC for Canadian waters increased to 186,000 (including an allowance of 11,000 for the Canadian Arctic).
1983-1985	TAC continued at the 1982 level.

Source: Canada, DFO (1985, Appendix IV).

TAC = Total allowable catch.

Table 30.2
Highlights of Management Measures Implemented
for Hooded Seals, 1965–1985^a

1965	Hunting banned in the Gulf of St. Lawrence.
1966	ICNAF assumed responsibility for management advice for north-west Atlantic.
1968	Open season defined as 12 March to 15 April.
1974	TAC set at 15,000 animals; opening and closing dates defined as 20 March to 24 April.
1975	TAC set at 15,000.
1976	TAC of 15,000 retained; opening date delayed to 22 March, shooting of seals banned between 23:00 and 10:00 GMT up to 31 March, and between 24:00 and 09:00 GMT thereafter (to limit loss of wounded animals).
1977	TAC of 15,000 retained; number of females to be killed limited to 10% of the total catch; shooting of seals in the water prohibited (to reduce loss by sinking).
1978	TAC of 15,000 retained; catch of adult females reduced to 7.5% of the total catch.
1979	TAC of 15,000 retained; catch of adult females reduced to 5% of the total catch.
1980	TAC of 15,000 and 5% limit on breeding females retained.
1981	TAC of 15,000 and 5% limit on breeding females retained.
1982	TAC of 15,000 and 5% limit on breeding females retained.
1983	TAC reduced to 12,000; previous conservation measures retained.
1984	TAC reduced to 2,340; previous conservation measures retained.
1985	TAC of 2,340 and other conservation measures retained.

Source: Canada, DFO (1985).

a. TACs as listed refer to total allowable catch in Canadian waters.

Apart from measures specifically directed at the conservation of stocks, a number of other regulations were introduced during the same period. In part they dealt with the administrative machinery needed to make the catch limits effective. Other regulations controlled the methods of killing and were directed at reducing the degree and frequency of any suffering inflicted on the seals. The chronology of these regulations is set out in Appendix 30.1.

How successful has been the Canadian management of harp and hooded seals, as measured against the objectives it was presumably expected to achieve? An immediate difficulty, particularly as far as conservation is concerned, is that for much of the period the objectives were only qualitative. Thus, in its brief to the Royal Commission, the Department of Fisheries and Oceans (DFO) declared as its current policy:

...that seals are considered a natural renewable resource available to be humanely harvested within the limits of sound conservation principles, taking into account its role in the ecosystem, with the object of gaining the maximum socio-economic benefits for Canadians in general, and those who depend directly on the resource in particular. This policy reflects a shift in 1976 from previous policies designed to achieve maximum sustainable productivity (Canada, DFO, 1985).

A quantitative objective was set in November 1978, when the European Community (EC) and Canada agreed to set an interim target population of 1.6 million harp seals aged one and older (Canada, DFO, 1985, p. 5). This objective, however, no longer seems to be followed.

The degree of success in achieving either maximum sustainable productivity (presumably roughly equivalent to maximum sustainable yield (MSY)), or a broader socio-economic objective, which must require a reasonably high sustained catch, can be judged from the history of the stocks reviewed in Chapter 21. In brief, it can be said that in the period from 1950 to the mid-1960s, these objectives were not achieved, and the stocks declined.

The blame for this mismanagement does not lie wholly with Canada. Canada had control only over Canadian sealers, but substantial catches (often amounting to well over half the total) were taken by vessels from other countries operating in what, until 1977, were waters outside any national

jurisdiction. Norway has been much the most important foreign country in the sealing industry, but since 1945, single vessels under the registry of Denmark, France, the United States and the U.S.S.R. have taken seals (Sergeant, 1965). Although ICNAF had responsibility for fisheries in the international waters of the northwest Atlantic since 1949, it gained authority to deal with seals only in 1966. The legal setting of seal management changed again in 1977, when both Canada and Denmark (in behalf of Greenland) established 200-mile fishery-management limits, which meant that harp and hooded seals could no longer be caught in the western Atlantic outside the jurisdiction of one or the other coastal state.

Since the 1971 season, when the quotas set by ICNAF in 1970 came into effect, the numbers of seals that can be caught have been limited by quotas which, since 1977, have included allowances that took account of unregulated catches by the aboriginal population in Greenland and northern Canada. Tables 30.3 and 30.4 indicate that, with minor exceptions, the regulations have been successful in keeping catches within the annual quotas.

The details of these quotas, and the effect that they have had on the stocks, are discussed in Chapter 21. In brief, it is clear that the quotas did stop the serious decline in harp seal stocks that had been in process. They probably did allow the stocks to increase, though the possibility of a small decrease cannot be ruled out on the basis of an analysis done for the Royal Commission (Cooke et al., 1986). The most recent analysis (Roff and Bowen, 1986), however, presents evidence of a substantial increase in the maturing stocks aged two to six years.

The situation concerning hooded seals is less clear, but it is more probable than not that average catches since 1972 have been below the replacement yield, and that the stocks have been increasing.

Judged against the broadest target, that of maintaining a productive stock, management since 1972 has been successful for harp seals and probably also for hooded seals. The only qualification of this assessment would be the slight possibility that one or other stock has been declining. The Royal Commission believes, however, that even if such a decline had been occurring, the existing management system, including the programs of monitoring and research, would have been sufficient to detect and reverse the decline before it became serious.

Table 30.3
Harp Seal Quotas and Catches in Canadian Waters

	Total Allowable Catch	Catch		
		Canada	Norway	Total
1971	245,000	132,660	98,306	230,966
1972	150,000	76,583	53,300	129,883
1973	150,000	65,542	58,290	123,832
1974	150,000	92,050	55,585	147,635
1975	150,000	114,202	60,161	174,363
1976	127,000	119,519	45,483	165,002
1977	170,000 a	119,519	35,624	155,143
1978	180,000 a	145,469	16,254	161,723
1979	180,000 a	140,253	20,288	160,541
1980	180,000 b	149,313	20,213	169,526
1981	183,000 c	175,450	22,382	197,832
1982	186,000 d	142,501	24,238	166,739
1983	186,000 d	57,889	–	57,889
1984	186,000 d	30,900	–	30,900
1985	186,000 d	17,723 e	–	17,723 e

Source: ICNAF/NAFO (1971–1984); Canada, DFO (undated, 1986).

- a. Including an allowance of 10,000 for northern aboriginal peoples.
- b. Including an allowance of 1,800 for the Canadian Arctic and 10,000 for Greenland.
- c. Including an allowance of 1,800 for the Canadian Arctic and a forecast catch of 13,000 for Greenland.
- d. Including an allowance of 11,000 for the Canadian Arctic.
- e. Preliminary data for Newfoundland and Quebec only.

Table 30.4
Hooded Seal Quotas and Catches in Canadian Waters^a

	Total Allowable Catch	Catch		
		Canada	Norway	Total
1971	-	432	14,514	14,946
1972	-	422	12,178	12,600
1973	-	312	6,255	6,567
1974	15,000	204	9,796	10,000
1975	15,000	5,385	10,226	15,611
1976	15,000	3,867	8,518	12,385
1977	15,000	6,044	6,049	12,093
1978	15,000	4,189	6,315	10,504
1979	15,000	6,819	8,306	15,125
1980	15,000	7,409	5,707	13,116
1981	15,000	8,309	5,367	13,676
1982	15,000	5,831	4,562	10,393
1983	12,000	128	-	128
1984	2,340	444	-	444
1985	2,340	452	-	452

Source: ICNAF/NAFO (1971-1984); Canada, DFO (undated).

a. Figures exclude research catches.

In relation to more specific and more rigorous targets of achieving MSY or an interim stock of 1.6 million harp seals, the evaluation is less clear. The total (late 1985) population of harp seals one year of age and older is probably not far from 1.6 million, and may well be in excess of that figure, though the possibility of its being a little less cannot be ruled out. It is far from clear what population abundance would give MSY, either in actual numbers or as a percentage of the original, unexploited population, and it is also possible that human exploitation of capelin and other species which the seals

eat could have reduced the population level required to give MSY under existing conditions. On balance, it is probable that the present stocks of both harp and hooded seals are below the MSY level corresponding to current environmental conditions.

Before concluding on this basis that management has been unsuccessful, two points would have to be made:

- Given that the stocks in 1970 were well below target levels, they could not be restored to those levels instantaneously.
- Neither the target of 1.6 million older seals nor that of MSY was ever unanimously accepted.

On the first point, the rate at which a depleted stock is rebuilt must usually be a matter of judgment that balances greater long-term benefits from a rapid rebuilding against the disruption to the industry likely to arise from the drastic measures required. Theoretical studies (e.g., Clark, 1976) suggest that, under certain assumptions, the greatest long-term economic benefits occur when the stocks are rebuilt as rapidly as possible. This is achieved by stopping all harvesting until the stocks have recovered to the target level. The International Whaling Commission (IWC), under its New Management Procedure, requires catches to be set at zero unless the stock is above, or only very slightly below, the MSY level.

Serious economic problems may not occur when the industry has alternative resources to harvest during a rapid rebuilding period. In this situation, a complete moratorium, such as the six-year one recommended by the Committee on Seals and Sealing (COSS, 1971) might be practical. It has the advantage of being easier to enforce than is a reduced catch. Most sealers, however, have no alternative resources during the sealing season and a moratorium would cause serious difficulty for them. Some catch, even if small, is preferable on social and economic grounds to zero catches for a period, followed by a major hunt. In the Canadian situation, therefore, it does not appear on purely economic grounds that the preferred speed of achieving the target population should be the fastest possible, brought about by a complete cessation of hunting. The actual speed of the process has to be a matter of choice, and there is little evidence to suggest that the speed that was being achieved in the late 1970s and early 1980s was either too fast or too slow.

On the second point, the weaknesses of MSY are reviewed in Chapter 27, and in Chapter 29 evidence is presented on gear damage, competition and

the spread of parasites from seals to fish, showing that for the Canadian fishing industry a small seal population would be desirable. It is far from clear what the optimum population of harp or hooded seals should be. That figure will almost certainly depend largely on the balance among the different factors considered above.

Humaneness

An important aim of management has been to reduce the cruelty involved in sealing. Most of the measures introduced in the mid-1960s concerning the types of club or hakapik allowed and the way either implement could be used related to this objective. There seems little doubt that these measures have significantly reduced the amount of suffering. (See Chapter 20.) It appears, however, that not all sealers always comply with the regulations. In 1981, as a result of unusual ice conditions, seals came close to the coast of Prince Edward Island and a number of inexperienced landmen took part in the hunt, some of whom did not use proper killing methods. This hunt, however, was closed down quickly when the federal authorities became aware of its non-conformity with regulations, and measures have been taken to prevent a repetition.

The extent of irregular methods in the main commercial hunt in recent years is unclear. The general impression from the information available is that enforcement of the sealing regulations improved during the late 1960s. It has since been generally effective, although there have been some exceptions. (See Chapter 20.) Unfortunately, the degree of distrust between the anti-sealing groups and the federal authorities remains great. Fishery officers and other authorities have devoted much time and energy to controlling the efforts by some protest groups to disrupt sealing operations. It is, perhaps, understandable that fishery officers, often themselves from sealing communities and familiar with local conditions, react as they do to the more extreme protest groups. It would not be surprising if, in some instances, they may have given more attention to enforcement of the laws against interference with the hunt than to enforcement of those concerning the activities of sealers.

Whatever its shortcomings, Canada's record of improving the humaneness of the commercial pup harvest is reasonably good. Hunting of seals older than pups, for both commercial and subsistence purposes, is carried out largely by shooting. The humaneness of this type of sealing has not been raised as a major issue.

Other Issues

From the preceding sections it appears that, measured against the requirements to conserve the stocks and to minimize any cruelty, Canada's record in the last 10 to 15 years, since there has been authority to apply measures over all the seal hunt, has been good. There have been shortcomings, but of no greater dimensions than those that have occurred in many similar situations of natural-resource management.

Nevertheless, Canada has come under very severe criticism for its stewardship of harp and other seal stocks, perhaps more severe than any other similarly responsible authority with the exception of the IWC. Some of these criticisms have been misplaced, based as they were on misconceptions, or applicable to the situation prior to the mid-1960s, rather than to current practices. Two substantive points have been made, however, that do merit examination: those of responsiveness and of excessive costs.

Responsiveness

At the technical level, the responsiveness of the Canadian authorities to scientific advice has been good. The quotas set have closely followed the recommendations of responsible scientific advisers. Similarly, the controls on methods of killing have largely conformed to the proposals of technical advisers.

It may be objected that these sets of advice came primarily from scientists employed by the management authority. For example, a large number of Canadian government scientists were on the ICNAF and NAFO committees. It is doubtful whether this circumstance made much difference to the substance of their advice. The conclusions concerning harp seals reached by the International Council for the Exploration of the Sea (ICES, 1983) and the United Kingdom's Nature Conservancy Council (NCC, 1982) groups, which were of very different composition, were similar to those reached by the ICNAF and NAFO committees.

One area in which valid criticisms can be raised, however, relates to the emphasis given to different interpretations of results when the basic analysis is inconclusive or ambiguous. The Canadian management authority has tended to act on the more optimistic interpretations. In this sense, it has been unresponsive to the general line of conservation thought as expressed, for example, by Holt and Talbot (1978), that in cases where there

is doubt, management should act on the more pessimistic interpretations of available data.

Criticisms of DFO on this point, in fact, are more relevant to the words of the Department and its apologists than to its deeds. There have been occasions, most noticeably in connection with the ICES report, when official Canadian statements, in claiming justification for Canadian policies, have chosen the optimistic interpretation of the results. (See Chapter 9.) Actually, the ICES report, to use that document as a convenient example, did provide good support for past Canadian actions.

Although quotas, and other policies, have not been set according to the most conservative interpretation of the data, neither have they been set at the other extreme. Quotas have generally been consistent with the central values of replacement yield, to take one example, and subsequent history does not suggest that they have erred significantly on the high side.

Criticism of Canadian management authorities for their lack of responsiveness has much less to do with technical issues than with basic policies. The central issue is whether or not the hunt (especially the white-coat hunt) should continue. The official Canadian position consistently has been that the seal hunt is a legitimate activity which, subject to controls for reasons of conservation or humaneness, should be allowed to continue. Rather than emphasizing as formerly the inhumane treatment of seals or the danger to stocks, the anti-sealing forces have now begun to object to sealing *per se*. The different categories of complaint are often confused or combined so as to strengthen the impression that there is a broad-based opposition to the hunt. (See Chapter 9.)

Whatever the grounds used for opposing the hunt and however receptive the public may have been to the anti-sealing appeals, it must be admitted that the Canadian authorities have not responded effectively. There has been no attempt, until now, to re-examine basic policy and the public response to that policy. At present, national policy is not consistent with the apparent public attitude towards sealing. If, on the one hand, public attitudes are strongly held on the basis of correct information, it would appear desirable to modify policy. If, on the other hand, the opposition to sealing is more apparent than real or, if real, has been based on misinformation or misunderstanding about sealing, it would be desirable to do more to inform the public and to determine what its attitudes really are. In a matter like sealing, which catches the public eye and arouses great public interest, but of which the public as a whole has no direct experience, it is as

important to keep the public adequately informed as it is to respond to apparent public attitudes.

Costs

The costs incurred by the Canadian government in connection with the seal hunt have included the following:

- biological research;
- direct support to sealing operations (e.g., assistance by ice-breakers);
- policing of regulations on the sealing grounds;
- general administrative activities.

It has been alleged that the total costs of these activities have been too high and that they may even have exceeded the value of the seal harvest.

Not all these costs are easy to determine because several of them involve general activities of the Department of Fisheries and Oceans, which would be carried on even if there were no sealing. The best available data on DFO costs are those provided in a letter from the Deputy Minister, dated 18 June 1985. This letter gave figures for the savings in the 1982 expenditure that might have been achieved if there had been no seal hunt; it included some estimates of additional costs incurred by the Ministry of Transport and the RCMP (Table 30.5).

It was explained that in some cases the potential savings in 1982 were different from the regular annual savings that might be achieved if sealing were stopped permanently. Thus the potential for savings connected with research in 1982 was less than the potential longer-term savings because much of the seal-related research could not be phased out immediately. The potential savings on publicity in 1982 were unrealistically large because, it was stated, the advertising campaign that took place in 1982 would not have been a regular annual expenditure. This statement may represent an optimistic view.

Biological research on seals is obviously important and would remain important even if the whitecoat hunt or other sealing enterprises were to cease. To find the answer to many questions important for the ordinary commercial fisheries requires research, especially concerning the competi-

tion for fish between seals and fishermen and the interrelationship between the various species of seals and parasitic infection of fish. In Chapter 29, the Royal Commission has recommended that research on these matters should be increased.

Table 30.5
Estimated Non-Expenditure in Absence of Seal Hunt

Activity	Savings in 1982 ^a	Regular Annual Savings
Research	\$137,000	\$247,000
Surveillance (by DFO, RCMP, MOT)	295,000	295,000
Ice-breaking	Nil	Nil
Publicity and public relations	240,000	50,000
External Affairs	5,000	5,000
COSS	60,000	60,000
	<u>\$737,000</u>	<u>\$657,000</u>

Source: May (1985a, 1985b).

- a. Savings in 1982 were considered different from "regular annual savings" because of special expenditures in 1982 and inability to phase out research immediately.

Even when one considers only the "intrinsic" value of the seals and the public interest in them, the present level of government-sponsored research appears to be fully justified. Matched against the total value of the relevant fisheries (for cod, capelin, flounder and other species), the costs of research appear small and well justified. The Royal Commission believes that research is vital for the wise management of any wildlife stock, even if the directed harvest is minor. Specifically, the Royal Commission believes that the current level of research into seals is barely adequate, and that the cessation of commercial sealing would not provide justification (or excuse)

for reducing current research expenditure. In other words, the suggested savings in research in the absence of sealing may be unrealistic.

To estimate zero additional costs to government for ice-breaking also seems unrealistic. Some savings must result from the idling of ice-breakers, which in the past operated in sealing areas during early spring, but the Royal Commission was unable to obtain an estimate of such savings from DFO. Presumably, it was argued that ice-breakers would be engaged in some activity and incurring costs even if no sealing took place and that no charge was made to DFO for their services. A more comprehensive evaluation of costs should take account of the potential benefits to be derived from the alternative activities. These costs presumably would be less than the total costs of the ice-breakers, but certainly not zero.

The costs of enforcing the sealing regulations depends in large part on the degree to which sealers accept the regulations as reasonable. It has been pointed out that, given the nature of the hunt, it is impossible, without a very large enforcement staff, for patrol officers to be present at every point where a seal is killed. Under normal circumstances, such an intensive check should not be necessary. Most people obey reasonable laws without a policeman looking over their shoulders. No evidence has been put forward to suggest that many sealers deliberately set out to break sealing regulations, whether in relation to conservation (open seasons and quotas) or to humaneness (proper use of the specified club or hakapik).

Before the confrontational extremes between sealers and anti-sealers created an atmosphere of distrust, the sealing regulations probably could have been enforced adequately by fishery officers in the course of their general duties, and any additional costs would likely have been reasonable in relation to the value of the seal hunt. If the regulations are now difficult to enforce and require direct supervision of individual sealers, the situation has come about largely because of the lack of trust between sealers and elements wanting tighter control on sealing operations. The policing and surveillance costs do seem high in comparison with the value of the products, but a high percentage of the costs can be ascribed to the strong controversy over Canadian sealing. The Canadian government has had to make sure not only that the regulations are enforced, but that they are also seen publicly to be enforced. The authorities must also keep order between the protesters and the sealers. Both groups may be pursuing legitimate activities, but they do not co-exist easily without disorder unless authority is present in force. The high costs of enforcement of some one-third of a million dollars should not be intrinsic to any sealing operation, in the absence of controversy and ill-feeling.

Given that the Canadian government considers sealing a legitimate activity, it is a proper responsibility of the government to respond to a movement attempting to stop the seal hunt. In itself, therefore, it would not be a valid criticism of government policy to state that the total money spent in connection with sealing exceeds the value of the harvest, even if this statement were true, though it can be asked whether that money has always been spent effectively. This last question is valid whether the efforts are considered solely as a defence of the sealing industry or, perhaps more properly, as attempts to provide a balanced picture of the issues involved.

The appropriate question about government expenditure on publicity, therefore, seems to be whether it represents a reasonable or an unduly expensive response to the public relations activities of those working to stop sealing. This does not imply that an exact dollar-for-dollar equivalence in the two sets of activities would necessarily be desirable. The fact that the expenditures mentioned – even the peak figure of \$240,000 in 1982 – are almost certainly much less than the public relations expenditures in the anti-sealing campaign (which are not well known) does suggest, however, that the former were not excessive. This assessment probably still would be valid if all government expenditures on public relations were included, for example, the activities of those officials in DFO and External Affairs, whose day-to-day workload during the past several years was dominated by the sealing issue, even if their duties were not specifically identified as being concerned with seals. It appears that the figures mentioned above cover only items which can be explicitly identified as dealing with publicity relating to seals, such as payments for advertisements. The true costs, especially to External Affairs, could be much higher than these figures.

A similar difficulty applies to the cost of support for sealing operations and to general administrative costs. The figures shown above indicate that the potential savings in these areas could be zero, excepting \$60,000 for COSS. This seems unlikely, or at least suggests that 1982, the year on which the figures were based, was not typical. On the other hand, there is no suggestion that these elements of overall cost have been excessive. They may not have been small relative to the actual cash value of the harvest, but it is believed that high costs are almost inevitable for activities largely carried out in small isolated communities.

Admission of Observers

A further ground for criticism of the way in which sealing has been managed concerns the admission of observers to the sealing grounds. It has

been suggested that the Canadian government has influenced the balance of opinion among observers towards regarding the hunt as humane by refusing permission for certain observers to visit the hunt (e.g., W.J. Jordan cited in Charlton, 1980; Harrison, 1985). In 1978, it was made necessary to have a government permit to visit the hunt.

The government's reasons for rejecting requests for observer status at the seal hunt are unknown. (See Chapter 9). It should be noted, however, that many persons who have received permission to observe the hunt have represented organizations that were opposed to the hunt. For example, the World Society for the Protection of Animals (WSPA), which was formed by the 1981 union of the International Society for the Protection of Animals (ISPA) and another organization, is "in principle opposed to the taking or killing of wild animals or the infliction of any pain, suffering or injury upon them" and has called upon the Canadian government to abolish the seal hunt (T.H. Scott, 1985). WSPA and ISPA have worked for many years to eliminate cruelty from the hunt and have sent many officers to witness the hunt. Walsh (1985), who has been an observer of the hunt for ISPA/WSPA on at least 10 occasions, stated that he had "viewed nearly all aspects of sealing activities," and that he had "never been restricted from seeing any aspect of the sealing operations, and the helicopter was usually put at the disposal of the observers to land anywhere we chose."

The Royal Commission believes that government has a responsibility to ensure that citizens are permitted to go about their legal activities without serious hindrance from others who may dislike those activities, however worthy they believe their motives to be. In exercising this control of access, however, the government should take care not to exclude people who have the willingness and technical competence to ascertain the facts about events at the hunt, whether or not their views conform with existing government policy.

Other Seals

Northern Fur Seals

Management of this species had been the subject of international agreement between Canada, Japan, the United States and the U.S.S.R. until very recently. (See Chapter 22.) Direct Canadian involvement in fur sealing was minimal during the 70-year period of international agreement, but

Canadian participation in the North Pacific Fur Seal Commission was active and contributed to the success of that body. Suggestions are made elsewhere (Chapters 22, 28) for possible alternative arrangements to take account of the termination of the Fur Seal Commission and the changing situation in the north Pacific, but in any event Canada should continue her policy of active international collaboration.

Other Temperate-Zone Seals

Though there apparently has been a small commercial hunt for harbour seals along the north shore of the Gulf of St. Lawrence (Beck, 1983), the main concern of government policy relating to harbour and grey seals in the Atlantic and to harbour seals and sea lions in the Pacific has been with their possible effect on fisheries. (See Chapter 29.) This concern has led to a number of measures to control the populations of these seals, principally through the payment of bounties to fishermen or through government-implemented culls.

Between 1927 and 1976, bounties were paid to fishermen on the Atlantic coast for harbour seals. Bounties were also paid on harbour seals between 1914 and 1964 in British Columbia, where the seals were also subjected to a hunt organized by federal fishery officers, killed opportunistically by fishermen and, between 1964 and 1969, killed for their pelts. The grey seal has been subject to a cull, executed by DFO, from 1967 to 1983 and bounties have been paid on grey seals since 1976. In British Columbia sea lions have been subjected to a variable, and at times intensive, control program, at intervals during the period 1912–1966. This program included organized culling by fishery officers, bounties and a commercial hunt for the production of leather and mink food. Since 1970, all seals and sea lions on the Pacific coast, including harbour seals, have been protected, though it is not impossible that some seals or sea lions are killed illegally.

The details of these programs, and the effect they have had on the stocks, are discussed in Chapters 21 and 22. The rationale for them has generally been expressed, if it has been explicitly stated at all, in very general terms, such as "for control purposes to reduce interference with salmon fisheries" (Canada, DFO, 1985, p. 86), or because of the harbour seals' "supposed role in fish consumption, damage to fishing gear and transmission of cod-worm" (Boulva and McLaren, 1979). The programs mostly concern interference with fishermen, though an additional justification has been the scientific value of the data obtained. The DFO brief (Canada, DFO, 1985, p. 82) states that "Until the necessary resources are available to replace it with

an equivalent program the bounty system is necessary for population estimation and trend monitoring.”

These programs must have kept seal numbers lower than they would have been in the absence of any cull or bounty kill. If they were intended to keep the seal population from increasing, the results must be considered mixed. Harbour seals on the Atlantic coast have been reduced and the bounty discontinued, but grey seals have increased in number, most notably on Sable Island. No seals from the Sable Island herd were killed there but some seals from this breeding ground might have been killed when they moved elsewhere. If the cull program was intended to reduce the grey seal population, it was not successful, although, presumably, it did do something to slow down the stock's increase elsewhere on the coast. In general, bounty and cull programs probably represent a response to pressure from fishermen for alleviation of a common nuisance.

Seals in the Arctic

The Canadian government has done little to manage seals in the Arctic. The DFO brief states that:

The DFO has recognized that maximizing economic benefits therefore must assume a lower priority in the Arctic seal hunt than do other objectives. To this end the Department has undertaken a low-level approach to regulatory management and has acted instead as stewards concentrating primarily on improving hunting practices through negotiations with HTAs [hunting and trapping associations] (Canada, DFO, 1985, p. 92).

Even when the catches of harp seals were being controlled on their wintering and breeding grounds in the Gulf of St. Lawrence and off Labrador and Newfoundland, no controls were set on the summer hunt in the Arctic. Only after the quota system had been in force for some time were the arctic catches explicitly taken into account and quotas set on the basis of an estimate of the likely catch.

As mentioned in Chapter 13, the Royal Commission agrees with this hands-off approach and believes that the federal government should devolve as much authority as possible to the aboriginal peoples of the North. How-

ever, some backing from the federal authorities will probably be necessary in such matters as research and compilation of data. Although some statistics relating to annual seal catches are available, including data on the sales of skins, these appear to be inconsistent and incomplete.

Future Management Policies

Research

An adequate understanding of the system being managed is essential to successful management. Research into seals and sealing is therefore an important part of seal management. As noted earlier, Canada already has a strong tradition of high quality seal research, but the changes in the sealing industry and in the problems being faced will require changes in research priorities. More attention should be given to the interactions between seals and fisheries, particularly through competition for fish and the transmission of parasites. The details of the problems being faced and of the research required to solve them have been discussed in Chapters 24, 25, 26 and 29. Here we are concerned with bringing together the different research requirements and putting them in the context of the overall management program.

The questions to which managers need answers, and need research to provide the answers, are not confined to biological problems. More information is required, for example, on the relation between the frequency of parasites in fish flesh and the costs to the processing industry for removing them, and on the views held by the Canadian public on the killing of seals to protect fishery interests. More socio-economic information is also needed; for example, on the patterns of life in isolated sealing communities, on the effectiveness of many of the public services they are receiving, and on the economic options they either have or, with government intervention, could have. Many major research problems are biological. Therefore, without forgetting the need for other types of research, this section will focus on biological research.

The more pressing questions about the dynamics of seal stocks now relate to the possibility of increased effects on fish stocks. How fast are some stocks, especially those of grey and harp seals, increasing? If no control measures are applied, how long will they continue to increase, and how

numerous will they be when they cease to increase? Questions about the effect on seal numbers of killing seals still require an answer, but in addition to asking them in the form, "How many can be killed without reducing the stocks?", which still remains an important query for ringed seals, the questions are now more often, "How few need to be killed to prevent the numbers of seals increasing beyond some target level?" It is commonly assumed that killing seals is the only effective way of limiting total numbers of seals. This assumption is probably true, but studies of alternative methods of control, such as disturbing the breeding sites, should not be neglected.

Some established lines of research will continue to be important, particularly regular monitoring of the abundance of seal stocks by aerial surveys or other methods, whether the concerns are with seals as an exploitable resource or as a potential menace to fisheries. In addition, where there is concern about the extent of future increases in the absence of human control, more research will be needed into the density-dependent factors which provide natural controls, such as changes in age at maturity and mortality rates, the levels of population abundance at which these factors become effective, and the aspects of the environment, such as food supply, to which they may be linked.

In general it seems that, apart from hunting, the effect of human activities on seals is minor and that, for this reason, research on these topics does not require particular attention. There are, however, exceptions. It is highly desirable to know whether the decline in fur seals in the north Pacific is the result of entanglement with debris and, if so, what can be done to reduce it. If development is likely in the Arctic, more needs to be known about the possible impact of heavy ship traffic on ringed seals and the likely effect of oil spills or other forms of pollution on these and other seals.

Most research will need to cover more than seals. To explain the effect on fish stocks, more data need to be collected on the diet of seals, and how it varies seasonally and geographically, but these studies should be better integrated with studies of the dynamics of fish stocks. Special attention ought to be paid to the factors that might seriously invalidate the simple assumptions made in Chapter 24. Do seals, for example, in any way feed selectively on sick or especially vulnerable animals? Attention in the first instance should be focused particularly on grey and harp seals on the east coast, and on harbour seals on the east and west coasts, but better information is desirable on the diet of all seals that inhabit Canadian waters.

The study of the problem of nematode infection requires an even broader approach. Certainly more data need to be collected on the occurrence of parasites in seals. Much of what is available is old, and it is often based on very few animals. Information is particularly poor and old for harp seals. It would be desirable to know soon whether or not, under the changed conditions of harp seal numbers and nematode abundance, harp seals have become or might become a significant carrier of the parasite.

This collection of data on the occurrence of parasites in seals must be combined with much more extensive collection of data on the occurrence in fish, including the variation with time and place, and with age and size of fish. Both sets of data must be brought together into a study of the dynamics of the parasite itself, to provide a much better insight into how changes in seal numbers might affect the rate of infection, and whether other approaches to reducing infection in fish might be available.

Studies of the direct impact of seals on fisheries, through damage to nets or removal of fish from nets, probably require less in-depth research but, as in other forms of impact, more needs to be done to collect systematically from surveys of fishermen, for example, the basic information concerning the extent of the damage.

The Royal Commission has not attempted to detail the research required or to estimate the costs. However, as indicated earlier, it is highly unlikely that the costs of seal research can be reduced. With the decline of the commercial hunt, some lines of research, such as studies to obtain more precise estimates of the sustainable yield of harp seals, can be reduced, but others, such as those relating to competition, need to be intensified. Overall, taking into account the complexities of some of the problems, it is probable that the resources put into research on seals and seal-related problems will need to be appreciably increased. It will be important also for this research to be co-ordinated or integrated with related research, for example, on fish stocks.

The costs to Canada of the required research could be reduced through collaboration with other countries. In some instances, such as those relating to the decline of the fur seal in the north Pacific, collaboration is essential because of the nature of the problem. In others, such as the dynamics of the *P. decipiens* population, the similarities of the problem in different countries make it much more efficient for countries to collaborate by exchanging information and sharing in the costs of those types of research, such as the development of theoretical models, which are best done in a single place with good access to the necessary expertise.

Location of Responsibilities

The management of seals and sealing is currently the responsibility of the Department of Fisheries and Oceans. When the problems involved were largely those of orderly regulation of the sealing industry, and when seals could be considered, primarily or exclusively, a natural resource to be used in the same way as fish stocks and other natural resources, this arrangement was quite appropriate and caused no difficulties.

This situation no longer exists. Many individuals and organizations do not consider seals to be merely a natural resource, and they challenge the view that seals should be exploited largely according to economic criteria. To the extent that this opinion is that of a majority or of a significant minority in Canada, the appropriateness of DFO as the responsible management institution becomes questionable. This concern might be intensified if Canadian policies on seals have to deal to a growing extent with the interactions between seals and fisheries.

The issue is valid and, if management involved only the making of policy decisions, in which the viewpoint adopted can be important, DFO's fitness for sealing regulation would certainly be doubtful. Many other activities are involved, however, including the collection of basic information, research, the development of management strategies and tactics (program design), and the implementation of regulatory programs. If there were no commercial sealing, or if under no circumstances were seals to be killed, some of these activities might decline in importance, but research, at least, would always be necessary. As related to sealing, the activities mentioned fall naturally within the ambit of DFO. The collection of basic information, for example, although needed only if a sealing industry exists, is most efficiently done by DFO as part of the general work of collecting fishery data.

The emphasis in research relating to seals is changing and is likely to change further in the future. Ten years ago the key questions were, "How many seals are there?" and "What is the sustainable yield and how does it compare with current catches?" Answers have been obtained to these questions. Although they are not precise or final answers, and relevant work should continue, they are reasonably accurate. It is generally realized that management can and should operate with assessments that are subject to some degree of error, provided that policy is adjusted accordingly. In any case, with the collapse of the market for sealskins and the consequent reduction of the harvest, the questions referred to have become less urgent

and may continue to be low in priority for some time, especially if all or some forms of commercial sealing are prohibited.

At present, the more urgent scientific questions concern the various effects of seals on fisheries. If some or all forms of sealing are prohibited so that the numbers of seals increase substantially, the latter questions will become of pressing urgency. Research into such questions must be closely integrated with research on the fisheries and fish stocks and with more general research on the marine ecosystem. All these matters are handled by DFO. Similarly, the enforcement of regulations concerning commercial sealing, conducted mainly by persons who are commercial fishermen at other times of the year, is most readily done by the DFO field staff as part of their normal regulatory duties.

Under present conditions, therefore, only future policy issues would not fall naturally and conveniently within the jurisdiction of DFO. If, for example, a decision were taken to kill a certain number of harp seals in order to benefit fishermen, opposition by several environmental or animal-welfare groups might be expected and, if this decision were taken solely by DFO, it might well be open to grave criticism as being prejudiced in favour of the fishermen. Judging from experience in Scotland, in respect of a proposed cull of grey seals in the Orkney Islands, the opposition could reach a level that would seriously impede operation of the program.

To ensure that justice for the seals, as well as for fishermen, is not only done, but is seen to be done, and that DFO is removed from a potentially impossible position, decision making in this area of policy should be more broadly based. A possible arrangement to achieve that end is proposed in the following section. Provided that it or an equivalent arrangement can be implemented, the Royal Commission believes that the responsibility for seals and sealing, at least on the Atlantic and Pacific coasts, should remain with DFO.

The situation is different in the Arctic. No large network of local fishery officers capable of handling the day-to-day collection of statistical and other information exists in this region. Moreover, relevant research does not fall entirely within the scope of DFO's activities. In particular, an important scientific question highly relevant to the management of arctic resources is the interaction between ringed seals (a responsibility of DFO) and polar bears and foxes (a responsibility of the Government of the Northwest Territories with some research also carried out by the Canadian Wildlife Service). There are also important issues relating to the possibly heavy, year-round traffic through arctic ice-fields that may result from hydrocarbon and miner-

al development and its impact on the environment, including the breeding lairs of ringed seals. (See Chapter 23.)

While it is possible for good research to be done under divided jurisdiction, it is more likely to be done as part of an integrated program under a single authority. The information available was insufficient to enable the Royal Commission to make a specific proposal. It is probable, especially if research on seals and polar bears is part of a large-scale program of research and conservation in the Arctic (which seems to the Royal Commission to be highly desirable), that authority should be divided between seal research in the Arctic and seal research in the other regions. This split in research on the same biological taxa seems less undesirable than the present split between polar bears and seals, that is, in research into the same ecosystem. Management policy in the Arctic also will have to take account of the legal position relative to the authority of aboriginal peoples over natural resources. (See Chapter 13.)

While the Royal Commission believes that responsibility for seals in the Atlantic and Pacific Oceans should continue to belong to DFO, it believes that within DFO there should be a clear division, especially in respect of policy formulation, between fisheries and seals. If possible, a separate unit, preferably headed by a senior officer, should be formed for sealing administration.

Another consideration relates to legislation for dealing with problems of seals. At present, seals and other marine mammals fall within the scope of the *Fisheries Act* which, on strict taxonomic grounds, is not wholly appropriate. For that reason, separate legislation to cover seals and, perhaps, marine mammals in general (possibly along the lines of the United States *Marine Mammal Protection Act of 1972*) might be indicated. With increasing significance of the interactions among seals, fish and other members of the marine ecosystem, however, such a legislative separation in coverage has serious disadvantages, even in biological terms. Whatever the superficially apparent benefits of a specific seal (or marine-mammal) act might be, the Royal Commission does not believe that they would be sufficient to justify the time and trouble involved in the preparation and enactment of new legislation.

Formulation of Policies

In his presentation to the Royal Commission on behalf of the International Union for the Conservation of Nature and Natural Resources

(IUCN), R.F. Scott (1985) pointed out the value of a scientifically based plan, agreed upon by all interested parties, for the management of any exploited natural population. While such a long-term plan for Canadian sealing, had it existed, probably would not have deflected all opposition to the seal hunt, it might have mitigated the problem to a significant degree. Much of the attack on the Canadian authorities arose not so much because of poor implementation of the chosen management policy as from disagreement over the policy being implicitly pursued. To be specific, certain individuals and groups explicitly reject the idea that sealing policy should be based on the treatment of seals as solely or mainly a harvestable resource. The extent to which such views receive public support makes it essential that they be taken into account in policy formulation.

The Royal Commission, therefore, while accepting DFO's retention of responsibility for the formulation and implementation of sealing policy, believes that provision must be made for input into the policy-making process from those representing the widest possible range of interest and knowledge. Specifically, the Royal Commission considers that a permanent mechanism (probably to be incorporated under legislation) should be established to advise DFO on the management and use of the seal resources of Canada. This advisory body (council or group) should be representative of biological, economic, social and ethical concerns and of public opinion on these matters. (Consideration might be given to the inclusion, perhaps only as observers, of participants from outside Canada, such as representatives of IUCN.) It should be assisted by a technical committee to provide advice on the tactical implementation of management strategy. If, for example, it were determined that growth of the grey seal population should be curtailed, it would be the committee's obligation to advise the administration concerning the measures (the number of seals to be culled, and so forth) to be taken.

While the Royal Commission believes that establishment of such an advisory committee would be of value to the Canadian government, both in formulating a soundly based policy for the management of the seal populations and in making it apparent to the public that a wide range of opinion had been taken into account, the Royal Commission recognizes that the decision-making authority would continue to reside with the government. In addition to its ultimate responsibility, the government may take notice of, and give weight to, considerations which were seen by the advisory committee as having little or no significance. Further, it may well be that the advisory committee is unable to reach a consensus on some matters of importance, and it is unlikely that any government would regard a simple majority vote within such a group as a convincing basis for significant management decisions. The question of the likelihood of reaching consensual advice

must be an important consideration in determining the composition of the advisory committee if one is established. Any decision on this question would have to be made in the face of conflicting pressures.

The narrower the range of interests represented on the committee, the more easily will consensus be achieved but, on the other hand, the more open will the government be to criticism that it is packing the group to achieve its own purposes. The same considerations could apply in the case of a technical committee such as the one suggested above. While it might be thought that such a group would be dealing with facts established on the basis of scientific evidence, matters of judgment, in actuality, are heavily involved in the interpretation even of scientific evidence. Although all scientists probably regard themselves, personally, as viewing evidence dispassionately, there is no doubt that a sizeable proportion of those working in such fields as marine-mammal management are regarded by some among their professional colleagues as consistently leaning in their judgments toward particular approaches to management. In these circumstances, it sometimes can be almost as difficult for a scientific advisory group to reach a consensus as it is for a less technically expert body to do so – as the International Whaling Commission has learned to its cost.

The Royal Commission does not think it appropriate to put forward detailed proposals for the composition of the advisory body and its technical committee and for their terms of reference. The body certainly should include representatives of sealers, of both harvesting and processing interests in the fishing industry, of aboriginal organizations and of environmental interests, as well as of government agencies such as DFO, and the Ministry of Environment, and of others such as university staff in the fields of biology (especially quantitative ecology), economics, sociology and philosophy. Consideration might also be given to separate groups for, or some clear division within the main group between, the Arctic region and the Atlantic and Pacific regions.

International Considerations

The events of the last few years have shown that problems of seals and sealing cannot be considered as purely a Canadian matter. Seal stocks are among the largest stocks of wild animals and some of them move from national to international waters or between the territorial waters of different countries. Their welfare is thus of international interest, especially in the United States and Europe. Just as it is important that Canadian policy

take account of all points of view and not only those of sealers and fishermen, it is also desirable that the views of people outside Canada be given some consideration. The Royal Commission, therefore, considered what mechanism might be devised for that purpose.

One alternative might be some form of international commission, like the several commissions for international fishery management. The closest analogy, that of the International Whaling Commission (IWC), is not comforting. The IWC has come under heavy criticism, not all fully justified, over its failure to effectively manage the stocks of large whales in the Antarctic and elsewhere. Of more concern in the present context is the degree to which the IWC has become polarized politically between states engaged in whaling and those that have taken a strong position against whale hunting. Although the IWC has agreed that its decisions should be based on science and not politics or economic interests, the agreement merely has had the effect of pushing political in-fighting from the IWC itself into the debates of its scientific committee. Attempts to prevent this are frustrated by the great uncertainties surrounding the results of most whale studies – which, on the whole, are no greater than those that surround most seal studies. Thus agreement on, say, a precise estimate of the sustainable yield of a given stock often becomes difficult or impossible because it involves issues of judgment by scientists with conflicting views. The experience with whales suggests that the establishment of an international sealing commission, with membership open to all, would not be a helpful endeavour. On the other hand, if membership were restricted solely to countries with sealing industries, the existence of a commission would not remove the criticism that the views of the wider world were being left out of account in the formulation of Canadian sealing policy.

It seems probable that the factors that have led to a wide range of countries becoming members of IWC, and to the clash between exploitative and conservational interests within that Commission, would apply also to any new international commission for seals, especially if it were expected to make formal recommendations about the management of seal stocks. It may be noted that Canada withdrew from the IWC in 1982 as a result of general dissatisfaction with its operations and specific concern over its role in relation to the management of small cetaceans in the Canadian Arctic.

On the scientific side, the prospects for productive international collaboration are brighter. The memberships of both ICES and NAFO are broad and include many of the countries whose citizens have been most vocal over the sealing issue. As these agencies now operate, the participants in their meetings are predominantly scientists working in government-funded fish-

ery research laboratories. As such, they might be held by some environmental interests to be not altogether unprejudiced, especially in the matter of interaction with fisheries. Even if that attitude were justified, it could be dispelled by widening the participation at meetings of technical working groups and similar bodies. To some extent, criticism of this kind might be reduced by means of the procedures proposed for more extensive consultation within Canada, including the establishment of an advisory committee with extensive membership. Indeed, consideration might be given to the inclusion of participants, if only as observers, from outside Canada, for example, from agencies such as IUCN, the U.S. Marine Mammal Commission and so on. Despite the other failings of the IWC, the activities of its scientific committee have shown that scientists from universities and other non-government institutions can work effectively in intergovernmental bodies and do not necessarily have to be part of national delegations or represent formal organizations.

A proposal for an international convention for the conservation of seals in the north Atlantic was put forward by Canada in discussion with representatives of the European Community (EC) and Norway in 1982 (Canada, DFO, 1985, Appendix XXXVII). This convention, it was suggested, would

- a) *Provide a system through which internationally agreed recommendations could be made to governments under whose jurisdiction seals were harvested, with a view to ensuring coherent and rational management of the seal stocks.*
- b) *Ensure that the parties engage in a rational consideration of all issues involved in the harvesting of seals.*
- c) *Provide a focus for the exchange of scientific information, discussion of research and consideration of joint research proposals on all seal stocks in the north Atlantic Ocean.*

In 1982, Greenland was still part of the EC and, consequently, a significant proportion of the kill of harp and hooded seals was under the latter jurisdiction. From the timing of the proposal, it seems also that an additional purpose of the convention would be to defuse some of the conflict between Canada and the EC over the sealing issue.

It appears that the Government of Canada had in mind a body with membership restricted to countries having a direct interest in sealing and with terms of reference chiefly of a scientific and technical nature. As such, it would have been potentially vulnerable to the criticism (noted earlier) that it was not fully representative of international concerns over seals. This may well have been the reason that the proposal was not accepted by the EC. On the other hand, it is unlikely that a more widely based convention, similar to the IWC, would have been acceptable to Canada.

A possible reason for a new commission is that not all species of seal live throughout their lives in waters under Canadian jurisdiction. Canadian stocks of harbour, grey, ringed and bearded seals probably are restricted to Canadian coastal waters, except for limited interchange across borders with the United States and France (St-Pierre et Miquelon). Harp and hooded seals, however, migrate between Canada and Greenland and are harvested in both countries. They may spend some time in waters in the middle of the Labrador Sea beyond the 200-mile limits of the two countries, but this involves a small part of the total population for a short period of each year. Canada's international commitments in respect of these species are dealt with through membership in NAFO. Northern fur seals carry out long migrations which take them through the waters of several countries as well as into waters beyond national jurisdiction. Canada and the other countries concerned have long recognized their international obligations regarding this species. The two species of sea lion migrate between Canadian and U.S. waters. In the absence of any significant hunt for these species, however, no formal arrangement for their conservation appears to be called for.

Since 1982, little action seems to have been taken by Canada or other countries toward the foundation of a convention covering all aspects of seals and sealing. This may be attributable to a conviction that such an agency would not be useful. The Royal Commission would agree with that view.

Whitecoat and Blueback Hunt

In Chapter 12 it was concluded that, to current public opinion, the clubbing of "baby seals" (whitecoat harp seals and blueback hooded seals) is completely unacceptable. With the collapse of the main markets the economic justification of this hunt has virtually disappeared. So long as the hunt is still permitted by law, however, the possibility of a significant kill of whitecoats remains an issue that can severely disrupt discussion of less controversial matters. The Royal Commission therefore believes that the killing of

the pups of harp seals (whitecoats) and hooded seals (bluebacks) for commercial purposes should not be permitted.

The restriction to commercial hunting is deliberate, since some subsistence killing is almost certain to occur in years when the ice brings the seals inshore, close to communities in the Magdalen Islands and elsewhere with a long tradition of killing seals for their own use. Public opinion does not seem to object nearly so strongly to this form of sealing. It seems wrong in principle to make an act illegal which in practice would be difficult or impossible to prevent on a small scale, and to which there are few very serious objections. Action should be taken, nevertheless, to ensure that any non-commercial harvesting of seal pups is limited in scale and conducted humanely.

Other Commercial Sealing

While some groups object to all killing of seals, objections to the killing of older seals are much less intense and much less widely held than are those relating to the killing of seal pups. The level of objections does not seem to warrant an immediate cessation of those forms of adult sealing which are important to many local communities. While the marketing of any seal product faces problems, the problems are much less serious, and the potential for economic benefit is greater, for an adult seal hunt than for a whitecoat harvest.

With the elimination of the large-scale killing of pups, smaller catches of older seals clearly offer no threat to the stocks of harp or hooded seals. A question exists concerning the status of some local stocks of ringed seals but no threat is posed thereby to the population as a whole. For most types of sealing cruelty and suffering is not a problem. The exceptions are netting and the deliberate shooting of seals to wound them so that they can be more easily approached and killed without a high risk of loss. As considered earlier, these forms of sealing should be phased out as soon as possible. (See Chapter 20.)

With these exceptions the Royal Commission does not believe that any immediate changes are necessary in the hunting of seals other than pups. It is essential, however, that the stocks concerned be properly monitored and that the operation of any hunt be kept under review to ensure that the infliction of inadmissible pain is avoided. It is also important that the state of public opinion and public information be kept under review, and that action be taken to ensure that the public has adequate information on which to make balanced judgments about sealing policy and practices.

Population Control

The possible control of seal populations on the grounds that seals damage fisheries will almost certainly present the most difficult problems in seal management in the next few years. The background to this issue is presented in Chapter 29, where it was shown that the extent of the total impact could be very considerable, but that there is much room for doubt about the exact extent of the different effects and the ways in which these could change in response to changes in seal abundance. It was also noted that as seal stocks increase, these problems will grow. The most urgent problems concern the harp and grey seals in the Atlantic region.

Although the total impact of harp seals on Canadian fisheries in dollar terms might be similar to that of grey seals, much greater uncertainty surrounds its possible magnitude. The effect per seal is clearly much smaller, and the reduction in total impact by a given amount would almost certainly involve killing a much larger number of seals. To achieve any significant control of harp seal numbers would involve killing several tens of thousands of animals, and it seems inevitable that a cull of this magnitude, coming so soon after the public outcry against the commercial harvest of harp seals, would involve a fresh public outcry on a comparable scale. Strong arguments against a cull from environmental and animal-welfare groups are particularly likely to occur in view of the substantial uncertainties that surround current estimates of the extent of the impact of harp seals on fisheries.

These doubts, especially those concerning the effects of competition for capelin and other fish, could be substantially reduced by increased research on these topics. In a few years it should be possible to have much better estimates of the extent of the impact. By that time also, the effects on the public of the recent anti-sealing campaign may largely have disappeared, and it should be possible to make a decision on whether or not to cull in a much less polemical atmosphere. The Royal Commission therefore believes that there should not be any cull of harp seals at the present time, but that the situation should be carefully reviewed in the light of new research, in two or three years' time. The Royal Commission also believes that serious consideration should be given to the advantages of employing ex-sealers in any future cull. Especially if these were to come from the communities that had been most gravely affected by the collapse of the sealskin market, the net economic and social benefits of a cull could be significantly increased.

The factors affecting a possible grey seal cull are more evenly balanced. The impact on the fisheries of an individual seal is, on the average,

clearly larger and is estimated with greater certainty, even though it is far from clear what the marginal effect of a small or moderate reduction of seal numbers would be on the damage caused to fisheries by seal-transmitted parasites. The economic benefit to Canadian fisheries would almost certainly exceed by several times the cost of a cull. It is unlikely that the outstanding doubts would be substantially reduced by research over the next two or three years, although such research would increase reliability to some extent and should not be neglected. The grey seal stocks are also increasing, certainly at Sable Island and almost certainly in Canadian waters as a whole, and the effect of competition, at least, will increase more or less in proportion. Any delay in deciding on a cull will compound the problem and even greater numbers would need to be killed if a cull were to be decided upon later. The case for postponing a decision is therefore much less convincing for grey seals than it is for harp seals.

On the negative side, it is possible that there would be wide public opposition to any cull of seals. Although culling of grey seals has been carried out regularly in the past without becoming the focus of much public attention, now that the commercial hunt of whitecoats is essentially finished, it is very probable that some, though not all, of the anti-sealing groups will focus their attention on the remaining instances of the killing of seals. The question of possible public attitudes is made more significant by the fact that if the cull is to be effective and carried out at reasonable cost, some of the seals would probably have to be killed on Sable Island. This place has the status of at least an unofficial nature reserve, and the killing of seals there would be likely to provoke more opposition than recent culls in the Gulf of St. Lawrence.

To reach a balance between the essentially economic factors indicating the desirability of a cull and the public reaction against a cull is not easy. This has to be a political decision in which good information on the nature and extent of potential opposition must be a key factor. The Royal Commission had little relevant information on this issue available to it. Indications from the poll conducted by Canadian Gallup Poll Limited for the Royal Commission (Chapter 11) suggest that the shooting of older seals might meet significantly less opposition than the clubbing of pups, but this evidence is not conclusive.

The best indication of public reaction should come after the publication of the Royal Commission's Report which, in addition to bringing the problem fully to the public's attention, also contains reasonably quantitative, though still definitely approximate, estimates of the extent of the economic impact of seals on fisheries. On that basis, the decision whether or not

to cull grey seals should be made soon. To ensure that public viewpoints on culling are taken into account, the decision should be made with the assistance of the representative advisory group proposed above.

If a decision is made in principle that grey seals or any other species of seals should be killed in order to reduce the impact on fisheries, further decisions need to be made on the number of seals that should be killed, the agents responsible and the manner of financing the operation. The determination of the number of seals to be killed and the sites of the kill are technical matters that should readily be settled in the light of the knowledge of the dynamics of the population in question. Account should also be taken of the need to minimize the risk of suffering, by shooting seals on land rather than on the water, for example, and to avoid undue costs.

Discussions in Chapter 29 point clearly to the desirability of any cull being carried out under the direct control of government so as to avoid cruelty, and to ensure that only the desired numbers are killed and that full biological information is collected. Bounty schemes as incentives for fishermen to kill seals are undesirable. Where fishermen are allowed to kill seals in their own immediate interests, near traps or other fixed gear, for instance, a small sum to cover the additional expenses involved might be paid in order to ensure the provision of biological information.

If the costs of a cull are small, they can be borne by the government as part of its general support for the fishing industry without raising significant questions. If costs are not small, then attention needs to be given to the question of who should pay for a cull. It might be argued that the impacts of seals are like the losses incurred in a normal period of bad weather, and should be borne by the fishing industry itself. It might also be considered that government-financed culls – and even more, government-financed bounty schemes – are concealed forms of subsidy.

If, indeed, there are to be significant financial benefits from controlling grey seals, it is possible that the industry itself might wish to arrange for the financing of culling costs. If it did so, it would provide a clear indication, in response to those who might doubt the evidence of the extent of the impact of seals on fisheries, that those directly concerned had no doubts and were prepared to financially back their views. This demonstration, in turn, would make public acceptance of the desirability of carrying out a cull more likely.

The possibility exists that, if there were strong public opposition, the government might not agree to carry out a cull, even though it would be

financed by the industry. In such a case, some form of compensation might possibly be contemplated. This should relate not to the total extent of damage from seals but to the net effect (reduction of damage less cost of culling) projected for a cull.

Conclusions

Since 1966, when mechanisms were established for effective international management of seal stocks, and especially since 1977, when Canada established jurisdiction over sealing and fisheries to a 200-mile limit, the management authorities have been successful in halting the decline in the abundance of harp and hooded seals. Effective measures have also been taken to reduce the amount of unnecessary cruelty involved. Canadian management objectives and practice have been consistent with sound conservation principles as set out, for example, in the World Conservation Strategy.

The Canadian management authorities have been fully responsive to the technical advice given concerning the status of the stocks and the use of different kinds of killing methods. They have been less responsive to those who have questioned the basic objectives of policy, and who have wished less emphasis to be placed on the use of seals as an economic resource.

The costs incurred by the Canadian government in relation to sealing have represented a significant, but in view of its nature, not an unduly high proportion of the total value of the hunt. Costs have been increased by the need to respond to the anti-sealing movement. Not all costs could be eliminated even if there were no sealing. Taking account of the growing awareness of the interaction between seals and commercial fisheries, and the great uncertainties surrounding many aspects of this interaction, the amount spent on seal research may need to be increased.

Many uncertainties surround all aspects of the impact of seals on fisheries. The present impact caused by the competition between seals and fishermen for the same stocks of fish is particularly uncertain, as is the extent to which the impact would be changed, in the case of damage due to transmission of parasites, by an increase or decrease in the number of seals. Resolution or reduction of these uncertainties is critical to the decision whether or not to institute a cull for any species of seal, and will require intensified research. Monitoring of the seal stocks and further research into their population dynamics also is needed.

Responsibility for seals and sealing is at present entrusted to DFO. This has meant that sealing policy is weighted towards, or at least is believed to be weighted towards, the treatment of seals primarily as a resource to be harvested for economic return or as animals to be controlled in the interests of fishermen. Those with different views about seals feel that their concerns are not adequately represented in the formulation of Canadian policy. The Royal Commission concludes that DFO, however, is the appropriate agency for dealing with most aspects of seal management, including research, the collection of statistics and the implementation of regulations.

In the Arctic, management policy for seals must be co-ordinated with the management of the predators on seals (bears and foxes). It will also have to take account of the legal position of aboriginal peoples with regard to control of the resources involved.

The formulation of a long-term seal-management plan or some similar expression of basic policy objectives, in which there would be inputs from a broad spectrum of interests in addition to DFO, could remove much of the present bitterness over sealing. This acrimony has arisen less from differences over technical matters than from fundamental differences in points of view about seals and sealing. Once a basic policy has been agreed upon by a group which includes environmental interests, DFO should have much fewer problems in implementing that policy.

The immediate need for such a policy is greatest in relation to the interactions between seal stocks and fisheries. Although not known precisely, the amount of loss caused, in one way or another, to the fishing industry, especially on the Atlantic coast, is already high and is likely to increase because, under current harvest rates, both harp and grey seals, which account for the greater part of the damage, are increasing in numbers.

Recommendations

1. The Department of Fisheries and Oceans, with the assistance of a representative advisory group, should explicitly establish for each seal stock both priorities for management and use that reflect social and economic values and management plans based on these priorities.
2. Management plans should be based on information on seal numbers, on seal impacts on fisheries and on public attitudes toward the killing of seals. They should include proposals for target levels of populations in the medium term, and for the number of seals, if any, that may be

killed in population control programs, subsistence hunting and commercial sealing.

3. Federal responsibility for seals in the Arctic should be closely coordinated with responsibility for the rest of the arctic ecosystem. Policy formulation should be a co-ordinated process involving aboriginal peoples, the Government of Canada and the Government of the Northwest Territories.
4. The government should consider transferring responsibility for seals on the Atlantic and Pacific coasts to a section of DFO, separate from those directly concerned with fisheries. The responsibilities of this section should include the protection of seals, management of any utilization and the interaction with fisheries.
5. Seal-management policies should be supported by an active, well-coordinated research program addressed to all the relevant issues. The financial and staff resources given to this program should be substantially greater than those given to seal research in recent years.
6. Non-commercial hunting of pups of harp seals (whitecoats) and hooded seals (bluebacks), to the extent that it occurs at all, should be carefully regulated and strictly limited.
7. Observers should be permitted to view any operation in which seals are killed, subject to such legal constraints as are necessary to protect personal rights and property.

Appendix

Appendix 30.1 Changes to Seal Protection Regulations^a

June 1959 SOR/59-191 ^b	<ul style="list-style-type: none"> ● Seal Protection Regulations (P.C. 1959-724) replaced Seal Protection Regulations made by Order in Council P.C. 5293-18 October 1949. ● Defined "resident" in terms of "defined area." ● Described "defined area" as waters north of 60° N and all of Ungava Bay, Hudson Bay and James Bay.
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Appendix 30.1 Changes to Seal Protection Regulations^a (continued)

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- Prohibited killing seals in the defined area except by residents for food and by others for scientific purposes.
 - Provided for sport hunt in certain areas north of 60° N under licence.
 - Limited sale and disposal of seal meat in defined area.
- February 1961
SOR/61-60
- Set out "Front Area" and "Gulf Area."
 - Established closed seasons for Front Area and Gulf Area.
 - Required licences for sealing from vessels.
- April 1961
SOR/61-160
- Closed seasons in Front Area and Gulf Area lengthened.
- February 1962
SOR/62-59
- Prohibited use of aircraft for spotting, except under licence.
 - Prohibited killing from aircraft.
- May 1962
SOR/62-171
- Established Cape Dorset and Whale Cove Regions.
 - Made minor changes in definitions.
 - Applied controls to sport hunting in Cape Dorset Region and Whale Cove Region.
 - Set sport quotas of 40 in each region.
 - Set daily sport bag limit of 3, only 1 of which might be a bearded seal.
 - Provided for the use of Inuit guides.
 - Prohibited retention of over 25 lb of meat by sport hunters, with excess to go to the Inuit.
- January 1963
SOR/63-16
- Established sport hunting quota for Frobisher Bay at 50 seals.

Appendix 30.1 Changes to Seal Protection Regulations^a (continued)

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- Permitted grey seals and harbour seals to be killed any time without a licence in areas where a bounty was offered.
- April 1963
SOR/63-135
- Defined "Frobisher Bay Region."
 - Changed regional sport hunting quotas to 60 seals each in Cape Dorset, Whale Cove and Frobisher Bay Regions.
 - Required use of aboriginal guides and their boats.
 - Changed the seasons in Gulf and Front Areas.
- March 1964
SOR/64-99
- Seal Protection Regulations (P.C. 1959-724) of June 1954 revoked and replaced by Seal Protection Regulations (SOR/64-99) of March 1964.
 - Prohibited seal hunting in the "defined area" except by residents for food or when authorized by the Minister for scientific purposes.
 - Instituted sport hunting provisions for Cape Dorset, Whale Cove, and Frobisher Bay Regions, with sport quotas established at 40, 60, 60, respectively, and daily limits of 3, only 1 of which might be a bearded seal.
 - Required that aboriginal guides and their boats be used by sport hunters; prevented retention of more than 25 lb of seal meat by sport hunters.
 - Prohibited sealing from vessels over 40 ft in length in the Gulf and Front Areas without licence.
 - Prohibited use of aircraft for spotting except with licence.
 - Prohibited the killing of seals from an aircraft.
 - Defined seasons in the Gulf and Front Areas.
 - Permitted killing of grey and harbour seals in bounty areas without a licence.

Appendix 30.1 Changes to Seal Protection Regulations^a (continued)

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| November 1964
SOR/64-443 | <ul style="list-style-type: none"> ● Set licence fees for vessels 40 ft and over, 65 ft and over, 100 ft and over, OAL.^c |
| | <ul style="list-style-type: none"> ● Seal Protection Regulations (SOR/64-99) revoked and replaced by Seal Protection Regulations (P.C. 1964-1963). ● Retained provisions as per SOR/64-99 (preceding regulations). ● Divided Gulf Area into Districts. ● Required sealing licences for all vessels over 30 ft in overall length. ● Closed District 2, Gulf Area to the hunting of hooded seals. ● Set a quota for whitecoats in District 2, Gulf Area. ● Prohibited use of aircraft in seal hunt except in District 2, Gulf Area; permitted use for spotting only, in the remainder of the Gulf Area and the Front Area; licences required in all cases; killing of seals from aircraft not permitted. ● Closed seasons for sealing from aircraft or vessels in Gulf Area and Front Area. ● Provisions allowing Minister to vary Gulf Area closed season. ● Required sealer's licence. ● Prohibited sealing with longlines. ● Set minimum weight and length for clubs. ● Prohibited skinning before death. ● Prohibited killing of adult seals in breeding and whelping patches. ● Required all sealskins to be removed daily from the ice to the base of operations. ● Permitted killing of grey and harbour seals without licence in bounty areas. |

Appendix 30.1 Changes to Seal Protection Regulations^a (continued)

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| March 1965
SOR/65-100 | <ul style="list-style-type: none"> ● Established licence fees. |
| June 1965
SOR/65-238 | <ul style="list-style-type: none"> ● Allowed use of aircraft in special circumstances in District 1, Gulf Area and the Front Area for 1965 only. ● Defined Coronation Gulf and Tuktoyaktuk Regions. ● Reduced sport-sealing quotas to 2 seals annually. ● Prohibited sport sealing of bearded seals. |
| February 1966
SOR/66-101 | <ul style="list-style-type: none"> ● Redefined Front and Gulf Areas. ● Redefined Districts 2 and 3, Gulf Area. ● Required that vessels over 30 ft in overall length be licensed; licence subject to terms and conditions prescribed by Minister. ● Prohibited killing of hooded seals in Gulf Area. ● Established quota for seals less than 1 year of age in District 2, Gulf Area. ● Provided for cessation of hunt in District 2, Gulf Area by Ministerial order. ● Restricted aircraft-sealing licences to Canadian aircraft, subject to terms and conditions. ● Required all sealers in Gulf and Front Areas to have a sealer's licence. ● Restricted killing weapons to <ul style="list-style-type: none"> (a) a gaff (defined) (b) a club (defined) (c) a rifle (defined) ● Except in District 1, Gulf Area and a portion of the Front Area, where net fishing by local residents permitted. |

Appendix 30.1 Changes to Seal Protection Regulations^a (continued)

- Prohibited hunting of adult seals in whelping or breeding patches.
 - Required that pelts be removed from ice within 24 hours.
 - Prohibited the removal of live seals except under permit.
- March 1966
SOR/66-115
- Authorized the Minister, for conservation purposes, to stop hunting in the Gulf by sealers operating from vessels less than 30 ft OAL or from shore.
- May 1966
SOR/66-235
- Seal Protection Regulations (P.C. 1964-1663) of 29 October 1964 revoked and replaced by Seal Protection Regulations (SOR/66-235, P.C. 1966-904).
 - Retained provisions per P.C. 1964-1663 (preceding regulations).
 - Defined "person of mixed blood."
 - Prohibited taking seals by longline.
- January 1967
SOR/67-52
- Added definition of "sealing."
 - Described seals by common and scientific names.
 - Exempted land-based aircraft searching for seals from the requirement to have a sealing licence.
 - Required all sealers in the Gulf and Front Areas to be licensed and to wear specific visible means of identification.
 - Set out criteria for acceptable clubs, rifles and shotguns.
 - Required use of clubs only for striking live seals and that seals be struck only on the forehead.
 - Prohibited hooking, skinning, bleeding or cutting of any seal until the seal is without doubt dead.
 - Required removal of seal pelts killed the previous day before killing could be continued.

Appendix 30.1 Changes to Seal Protection Regulations^a (continued)

- Made masters of ships and pilots of aircraft responsible for the behaviour of their crew or passengers.
- Restricted hunting hours in the Gulf Area.
- Provided for immediate suspension of a licence by a fishery officer for a period not exceeding 30 days.
- March 1968
SOR/68-78
 - Changed Front and Gulf seasons.
- February 1969
SOR/69-79
 - Changed Front and Gulf seasons.
- March 1970
SOR/70-108
 - Redefined Gulf Area and Front Area.
 - Defined "whitecoat."
 - Prohibited killing of whitecoats in Districts 2 and 3 of the Gulf Area.
 - Prohibited use of aircraft in sealing except while searching for seals.
 - Required searching aircraft to be licensed.
 - Restricted aircraft eligible for licensing to those registered under Part II of the Air Regulations made pursuant to the *Aeronautics Act*.
 - Provided for prescribing of terms and conditions in an aircraft-sealing licence.
 - Prohibited landing of aircraft less than 1/2 nm^d from any seal herds in the Gulf or Front Areas.
 - Defined seasons for all sealers in the Front and Gulf Areas, with an exception for residents of District 1 of the Gulf Area operating from shore or from vessels of less than 30 ft OAL.
 - Removed requirement that a pilot be responsible for the hunting behaviour of his crew.

Appendix 30.1 Changes to Seal Protection Regulations^a (continued)

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- | | |
|-----------------------------|---|
| March 1971
SOR/71-127 | <ul style="list-style-type: none">• Defined "registered net tonnage."• Removed division of Gulf Area into Regions.• Stopped issue of vessel-sealing licences to vessels of over 65 ft OAL unless those vessels were licensed in 1969 or 1970.• Set quotas for harp seals of 50,000 in each of Gulf Area and Front Area for vessels over 65 ft.• Revised sections pertaining to seasons in Gulf Area and Front Area.• Restricted off-season taking of seals from shore or small boats to local residents.• Restricted netting of seals to local residents.• Amended licence fees. |
| August 1971
SOR/71-397 | <ul style="list-style-type: none">• Established closed season for Murray Harbour, P.E.I. |
| December 1971
SOR/71-648 | <ul style="list-style-type: none">• Revised closed season for Murray Harbour. |
| March 1972
SOR/72-72 | <ul style="list-style-type: none">• Revised eligibility criteria for licensing vessels over 65 ft OAL.• Revised harp seal quota for Front Area vessels over 65 ft OAL.• Prohibited harp seal hunting in Gulf Area from vessels over 65 ft OAL.• Set combined harp seal quota for landmen in Gulf and Front Area. |
| June 1972
SOR/72-186 | <ul style="list-style-type: none">• Provided some relaxation of seal sport-hunting provisions for residents of defined areas. |
| March 1973
SOR/73-159 | <ul style="list-style-type: none">• Revised seasons for harp seals in Gulf and Front Areas and for hooded seals at Front. |

Appendix 30.1 Changes to Seal Protection Regulations^a (continued)

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|-----------------------------|---|
| April 1974
SOR/74-216 | <ul style="list-style-type: none">● Redefined "resident."● Prohibited landing of aircraft within 1/2 nm of a seal. |
| March 1976
SOR/76-172 | <ul style="list-style-type: none">● Defined "hakupik" and "sealing crew."● Revised quota for harp and hooded seals hunted at the Front from vessels over 65 ft OAL.● Prohibited landing aircraft within 1/2 nm of a seal except under permit.● Prohibited overflying seals at less than 2000 ft altitude except under permit.● Adjusted hunting seasons for harp and hooded seals in Gulf and Front Areas.● Required hunters to hold either sealer's or assistant sealer's licence.● Established criteria for sealer's and assistant sealer's licence (i.e., sealers: 18 years of age or over, 2 or more years experience sealing and being a sealing group leader; assistant sealers: 15 years of age or over).● Limited hunting activity of inexperienced sealers.● Permitted use of hakupik in Front Area.● Established closed season for grey seals.● Prohibited tagging or marking of live seals except under permit.● Limited hunt to specific hours during the day.● Amended licence fees. |
| February 1977
SOR/77-181 | <ul style="list-style-type: none">● Defined "Regional Director."● Redefined "hakupik." |

Appendix 30.1 Changes to Seal Protection Regulations^a (continued)

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- Adjusted eligibility criteria for sealing-vessel licences.
 - Revised quotas and seasons.
 - Permitted variation of seasons or quotas by a Regional Director General.
 - Provided for broadcast or publication of variation orders.
 - Permitted sealing from vessels over 65 ft OAL in Gulf with Ministerial permission.
 - Set out adult sealskin quotas for large vessels as percentages of catch on board (5% harps over 1 year; 10% female hoods).
 - Required persons operating from shore or in small vessels to take seals only off that part of province where they reside.
 - Ordered that hooded seals be struck with a hakapik after being shot.
 - Revised some hunting hours.
- October 1977
SOR/77-828
- Revised provision for closed season in Murray Harbour and added a closed season for Gaspé.
- C.R.C. 1978
c. 833
- Consolidated Regulations of Canada, Chapter 833.
- February 1978
SOR/78-167
- Defined Lake Melville Area.
 - Defined "landsman."
 - Permitted residents of Labrador to take seals at Front at any time.
 - Added prohibition against persons without permits coming within 1/2 nm of any area where sealing is taking place.
 - Detailed application requirements for a permit to visit the hunt.
 - Restricted harvesting of ringed seals in Lake Melville Area to residents.

Appendix 30.1 Changes to Seal Protection Regulations^a (continued)

-
- Required that Lake Melville hunters hold sealer's licences.
 - Required that a club or hakapik be on board a sealing vessel.
 - Established various means by which ringed seals in Lake Melville might be taken.
 - Established criteria necessary to declare a seal dead.
 - Imposed a duty on vessel masters to ensure their crews complied with the Regulations.
 - Revised hunting hours.
 - Added ringed seals to Schedule II.
 - Revised Schedule III relating to quotas and seasons.
- March 1978
SOR/78-237
- Revised schedule to read "Canadian" rather than "Gulf" based vessels over 65 ft OAL.
- March 1979
SOR/79-213
- Modified Front Area and Gulf Area.
 - Redefined "sealing."
 - Revised provisions on licensing large vessels.
 - Provided for possibility of issuing new vessel licences.
 - Limited validity period of licences.
 - Further limited catch of female hooded seals.
 - Permitted use of hakapik in Gulf by sealers from large vessels.
 - Required exsanguination of a dead seal.
 - Provided a closed season in St. Lawrence and Saguenay Rivers.
 - Modified Schedule III dealing with quotas and seasons.

Appendix 30.1 Changes to Seal Protection Regulations^a (continued)

- | | |
|------------------------------|---|
| September 1979
SOR/79-676 | <ul style="list-style-type: none">● Corrected inconsistencies between French and English versions. |
| February 1980
SOR/80-115 | <ul style="list-style-type: none">● Redefined Lake Melville Area.● Set out eligibility criteria for licensing sealing vessels over 65 ft OAL.● Restricted daily kill of adult female hooded seals by sealers operating from a vessel over 65 ft to 5% of total number of hooded seals taken by sealers from that vessel.● Required that the hood remain attached to all adult male hooded seals until taken on board a vessel.● Required that all seals killed by means of a club or hakapik be struck on head three times or until skull is crushed.● Prohibited a "sealing group" from stockpiling more than 10 seals that have not been pelted. |
| December 1980
SOR/81-18 | <ul style="list-style-type: none">● Altered some licence fees.● Amended some seasons. |
| February 1982
SOR/82-269 | <ul style="list-style-type: none">● Redefined Front Area and Gulf Area.● Required all vessels 35 ft or more OAL to be licensed to engage in sealing.● Revised quotas and closing times for 1982 sealing and revised procedure for varying quotas and closing times.● Increased percentage of harp seals 1 year or older that a vessel over 65 ft may have on board (from 5% to 6%).● Prohibited landsmen operating from vessels 35 ft or more OAL from taking whitecoats in Front Area and the northern portion of Gulf Area.⁹ |

Appendix 30.1 Changes to Seal Protection Regulations^a (continued)

	<ul style="list-style-type: none"> ● Set out revised licence criteria for sealer's licence and assistant sealer's licence. ● Redefined maximum length and width for club used to kill seals. ● Restricted taking of grey seals under bounty to licensed sealers.
July 1983 SOR/83-588	<ul style="list-style-type: none"> ● Removed reference to Minister of Province of Quebec in the licensing provisions.
December 1983 SOR/84-64	<ul style="list-style-type: none"> ● Revised definition of "Regional Director General." ● Revoked duplicative section.
February 1984 SOR/84-201	<ul style="list-style-type: none"> ● Clarified that a person, when clubbing a seal, must crush the skull before proceeding to skinning stage.

Source: Canada, DFO (1985).

- a. Seal Protection Regulations were first made by Order in Council P.C.5293-18 October 1949. These regulations which, in their present form, apply to bearded, grey, harbour, harp, hooded and ringed seals, define the areas, times and methods by which seals may be killed; and prescribe certain other conditions, including those related to sport hunting, the use of meat, licence requirements, the use of helicopters or other aircraft, and observers approaching a seal or an area where the hunt is being carried out. Requirements relating to licence fees, quotas and closed times are included as schedules to these regulations.

It is important to note that quotas and closed times may be changed by "variation order" so that quotas listed in the regulations do not necessarily reflect those actually in effect. For example, while the 1983 regulations list the quota for hooded seals as 15,000, the quota was actually 12,000. In 1984 and 1985, the quota for hooded seals was set at 2,340; however, because anticipated harvest levels were substantially lower than this number, variation orders were not issued.

- b. SOR = Statutory Orders and Regulations.
 c. OAL = overall length.
 d. nm = nautical mile
 e. This was the result of an industry decision and was made in exchange for an allocation of hooded seals.

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**Administrative
Appendix**

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1. Statement of Policy and Procedure

Adopted at the first meeting of the Royal Commission, 24-26 September 1984.

Introduction

A Commission of Inquiry has been constituted under Part I of the *Inquiries Act*, R.S.C., 1970, C.I-13 by Order in Council P.C. 1984-2242 dated 22 June 1984 to conduct a full inquiry as more particularly set out in the terms of Reference into seal resource management and the seal industry in Canada.

The Commission has been directed to submit a preliminary report to the Governor General in Council not later than 31 December 1984, and its final report is to be submitted by 30 September 1985.

Commissioners

The seven Commissioners who have been appointed are:

The Hon. Mr. Justice Albert H. Malouf
Court of Appeal
Montreal, Canada
Chairman

Dr. Kenneth Radway Allen
Fisheries biologist
Cronulla, N.S.W., Australia

Mr. Russel Lawrence Barsh
Attorney - indigenous rights
Seattle, Wash., U.S.A.

Dr. Patrick Geistdoerfer
Biological oceanographer
Paris, France

Dr. John A. Gulland
Fisheries biologist
Cambridge, England

Prof. Robert Ian McAllister
Economist
Halifax, N.S., Canada

Dr. Wilfred Templeman
Marine biologist
St. John's, Nfld., Canada

Terms of Reference

The Commission's mandate is to investigate and make recommendations on all aspects of seal resource management and sealing in Canada, and especially on the economic viability of the seal industry and, without limiting the generality of the foregoing, the Commission shall inquire into and report on:

- (a) the social and cultural impact and economic benefits and costs, including regulatory costs, of sealing in Canada;
- (b) the ethical considerations relevant to the harvesting of seals;
- (c) the status of Canadian seal stocks and measures currently in force in Canada to conserve, manage, protect and regulate the harvesting of seals, including the adequacy of such measures;
- (d) the interactions between seals and commercially exploited fish populations that may affect food supplies or contribute to parasite transmission;
- (e) the interaction between seal populations and commercial fisheries, including, *inter alia*, competition between seals and fishermen for fish stocks; interference in fishing activity by seals, including damage to fishing gear and catches; and the effects and related economic costs on the quality of fish catches caused by transmission of parasites by seals;
- (f) the principles necessary to manage seal stocks for conservation purposes, including appropriate cull levels, so as to ensure the continuing abundance and health of seal stocks and to minimize adverse interactions between seals and Canadian fishing resources and operations;
- (g) the methods for harvesting seals commercially and their suitability;
- (h) the domestic and international opportunities for and constraints on the processing and marketing of Canadian seal products;
- (i) the availability of alternative sources of income and opportunities for adjustment for individuals and communities currently dependent on the seal harvest;

- (j) the concerns of individuals and groups with a direct, indirect or declared interest in sealing in Canada, including an assessment of such interests;
- (k) the public awareness and attitudes in Canada and abroad on sealing policies and activities in Canada and the extent to which such attitudes could constrain future revitalization of commercial sealing, or adversely affect other commercial interests and activities, and recommend approaches for removing those constraints;
- (l) the international comparisons, as appropriate, for the preceding elements, and
- (m) the possible new international initiatives for managing Canada's seal resources, for harvesting seals and for related activities.

Office

Effective 12 November 1984, the office of the Commission shall be at:

Palais de Justice
Suite 9.80
1 Notre-Dame Street East
Montreal, Quebec
H2Y 1B6

Rules of Practice and Procedure

In order to fulfil its mandate, the Commission deems it appropriate to adopt certain rules of practice and procedure. The Commission therefore decrees the following rules:

Public Hearings

1. Hearings of the Commission will be held at such times and places as the Chairman shall decide.
2. Notice of public hearings shall be published in advance in such daily newspapers or other periodicals as are likely to convey the notice to interested members of the public.

3. Except with the consent of the Chairman, photographs, films, cable distribution, television, video tapes and all forms of recording shall be prohibited at Commission hearings, subject to Rule 13.
4. When the Chairman considers that disclosure of testimony is likely to be detrimental to the interests of justice; or to cause unwarranted prejudice to the reputation of a witness or of another person, the dissemination of such testimony may be prohibited according to the terms and conditions and for the period determined by the Chairman.

Private Hearing

5. The Commission may hold private hearings when the Chairman considers them necessary. Only those persons authorized by the Chairman will be permitted to be present at such hearings.

Administration of Proof and Hearing

6. The Chairman may designate one or more members of the Commission to gather such information as he may deem necessary to fulfil the mandate of the Commission.
7. Every exhibit or document produced shall be identified by a number which shall be used throughout the inquiry.
8. A witness who testifies at a hearing may be required to testify under oath or by affirmation.
- 9.1 During hearings before the Commission, persons may submit evidence and facts to the Commission on any matter within its terms of reference by oral testimony, or in such other manner as the Chairman shall determine.
- 9.2 The Commission may at any time it deems appropriate ask such questions as it considers useful of witnesses appearing before the Commission.
- 10.1 Any person, corporate body, association, organization, group of persons, union or public body (hereinafter referred to as "person")

wishing to be heard by the Commission may request the Chairman's authorization to be heard or to have other persons heard.

Such requests must be submitted in writing to the Commission and must indicate the general nature of the presentation, a list of supporting material, if any, the reasons for which the Chairman should grant the authorization, the surname(s), given name(s) and address(es) of the person(s) to be heard, and an estimate of the time required to hear the presentation.

- 10.2 The Chairman reserves the right to deal with the information so offered in such manner as he deems advisable, consistent with the terms of the Order in Council creating the Commission.
- 10.3 The Chairman may accede to this request in whole or in part, according to the terms and conditions he sets, or reject it.
- 10.4 When such a request is granted, the witness shall be invited to appear.
- 10.5 The Chairman may, in his discretion, limit the amount of time allowed to any one person for hearing a presentation.
11. The Commission may adjourn hearings at such a time and date as it considers appropriate.
- 12.1 Any person may testify before the Commission in French or in English.

The Commission shall, however, provide the services of an interpreter at its own expense for any person whose knowledge of French or English is insufficient for the purposes of his testimony.

- 12.2 Any person who wishes to avail himself of the services of an interpreter must notify the Executive Director or the clerk of the Commission a reasonable time before the date set for his hearing, indicating the language in which he wishes to testify.
- 12.3 Only interpreters accredited to the Commission may act at hearings.
13. During the hearings, the Commission shall have the witnesses' testimony recorded by stenography or by any other means it deems appropriate.

Submission of Written Briefs

- 14.1 Any person, corporate body, association, organization, group of persons, union or public body (hereinafter referred to as "person") wishing to submit a written brief to the Commission may do so by following the procedure hereinafter described.
- 14.2 The briefs may deal with any matter within the terms of reference of the Commission. The briefs should be as concise and succinct as possible and may be accompanied by supporting material. Each brief should be signed and should indicate the surname(s), given name(s) and address(es) of the persons responsible for the preparation of the said brief.
- 14.3 Whenever possible the text of each brief should be presented in typewritten double-spaced form, on one side of paper measuring 21.5cm X 28cm (8 1/2" X 11").
- 14.4 Ten copies of each brief should be submitted to the Commission. If it is not possible to submit such number of copies for any reason whatsoever, the Commission shall undertake to produce its own copies at its own expense.
- 14.5 The briefs may be submitted to the Commission on a confidential basis. However, the Chairman reserves the right to deal with the information offered in each brief in such a manner as he deems advisable, consistent with the terms of the Order in Council creating the Commission.
- 14.6 The persons submitting briefs to the Commission may also request to be heard by the Commission. The Chairman may accede to this request in whole or in part, according to the terms and conditions he sets, or he may reject it.

Miscellaneous Provisions

- 15.1 Records of the Commission shall be maintained at its office until such time that the final report of the Commission is submitted to the Governor General in Council.
- 15.2 Subject to Rules 4 and 16, any person who wishes to take cognizance of exhibits or documents produced or depositions obtained before the

- Commission must obtain prior authorization from the Chairman. The Chairman may specify the terms and conditions under which such authorization is granted.
- 15.3 Any person so authorized must present himself at the Commission's office during office hours on juridical days in order to consult the file in the presence of the Executive Director of the Commission or his representative.
 16. A witness may at any time take cognizance of his deposition and of the exhibits he has produced. No other person may take cognizance of the depositions obtained and the exhibits produced without the authorization of, and according to the conditions set by, the Chairman.
 17. A witness may be compelled to appear and testify before the Commission by summons and must attend the hearing at the place, time and date indicated in the summons, failing which he shall be subject to such penalty as is provided by law.
 18. Any person summoned to testify before the Commission in public or private hearings shall be entitled to a reasonable travel allowance, on presentation of supporting documents approved by the Executive Director of the Commission and at a rate fixed by law, for each day on which he presents himself before the Commission, whether he testifies or not.
 19. A person required by summons to produce a document or thing at a hearing of the Commission shall produce the document or thing at the place, time and date indicated in the summons, failing which he shall be subject to such penalty as is provided by law.
 20. The Commission may engage the services of such consultants and staff as are required to conduct research, prepare reports, and make presentations to the Commission.
 21. Anything which interferes with the decorum and good order of the hearings shall be prohibited.
 22. These rules are intended to facilitate the Commission's work and must be so interpreted.

Admissibility of Photographs, Films, Videos, and Other Similar Evidence (hereinafter called photographs)

Adopted at a meeting of the Royal Commission, 22 January 1985.

23. Admissibility of photographs depends on:
- a) Accuracy in truly representing the facts.
 - b) Fairness and absence of any intention to mislead.
 - c) Verification on oath by a person capable of doing so. It is not imperative that photographs be verified through the sworn evidence of the person who was responsible for taking them; other persons familiar with the event portrayed in the photographs can be permitted to identify such pictures.

The procedure will be as follows:

- 23.1 The person wishing to submit photographs as evidence before the Commission must forward to the Commission in writing all the pertinent details concerning such evidence including the date, time and place where the photographs were taken, the equipment used, the name of the photographer and, if applicable, the names of the director and producer of same.
- 23.2 The person submitting this evidence must advise the Commission whether any or all of the persons mentioned in paragraph (1) herein who are responsible for the creation and the production of the said evidence are available for examination by the Commission. Access to these individuals must be given to the Commission in order to allow it to investigate the authenticity of the said evidence. Furthermore, the person responsible for submitting this evidence to the Commission must agree to allow the Commission to analyse the evidence through the use of technical experts if necessary.
- 23.3 The evidence submitted to the Commission will be viewed by representatives of the Commission, and the Chairman will then advise the person wishing to submit the evidence of the conditions under which the evidence will be accepted. The Chairman may, however, refuse to accept such evidence.

- 23.4 The Commission, as stipulated in the "Statement of Policy and Procedure", reserves the right to deal with the evidence so offered in such a manner as the Chairman deems it advisable, consistent with the terms of the Order in Council creating the Commission.

2. Groups and Individuals Submitting Briefs to the Royal Commission

A. Garrigus Pentecostal Collegiate (Grade X class)

Abadie-Maumert, F.A.

Animal Defence League of Canada

Arche II/Ark II

Arctic Cooperatives Limited

Association des biologistes du Québec

Association des chasseurs de phoque
des Îles-de-la-Madeleine (A. Miousse)

Atlantic Marine Wildlife Tours Ltd. (J.E. Lewis)

Attagoyuk School (E. Kilabuk, C. Aningmiuq)

Baffin Divisional Board of Education (J. Mike)

Baffin Region Hunters and Trappers
Committee (S. Atagootak)

Baffin Region Inuit Association (Keyootak, P.)

Barry, Hon. L., Leader of the Opposition,
Province of Newfoundland and Labrador

Boxer, Hon. B., House of Representatives,
Congress of the United States

Brenner, J.

Canadian Federation of Humane Societies

Canadian Nature Federation (R. Fox)

Canadian Sealers Association

Canadian Society for the Prevention of Cruelty to Animals

Canadian Veterinary Medical Association

Canadian Wildlife Federation

Canadians for the Abolition of the Seal Hunt (T. Harrison)

Carino Company Limited (B. Nygaard, C. Rieber)

Chabot, J.

Chambre de commerce des Îles-de-la-Madeleine

Clarke, B.

Commission de développement des pêches des Îles-de-la-Madeleine

Committee on Seals and Sealing (T.I. Hughes)

Cournoyea, Hon. N. J., Minister of Renewable Resources,
Government of the Northwest Territories

Curley, Hon. T., Minister of Economic Development and Tourism,
Government of the Northwest Territories

Currey, J.E.

Department of Economic Development and Tourism
(Baffin Region) NWT

Department of Fisheries and Oceans, Canada

Department of Indian Affairs and Northern Development, Canada

Dupras, G.R.

Eastern Fishermen's Federation

Emond, D.P.

Eyre, S.M.

Fauna and Flora Preservation Society, Inc. (J.C. Walsh)

Felsberg, S.

Fisheries Association of Newfoundland and Labrador Limited

Fisheries Council of British Columbia

Fisheries Council of Canada

Fur Council of Canada

Fur Institute of Canada

Geistdoerfer, A.

Gourlay, L.

Government of Newfoundland and Labrador, Department of Fisheries

Grand Council of the Crees (of Quebec)

Greenpeace International (V. Bøe)

Greenpeace – Toronto (D. McDermott)

Greenpeace – U.K.

Henderson, G.

Henke, J.S.

Hicks, J.

Holman Hamlet Council (I. Aleekuk)

Holman Hunters and Trappers Association

Hyslop, J.

Indigenous Survival International

International Council of Environmental Law

International Council for the Exploration of the Sea

International Fund for Animal Welfare (Briefs prepared on its behalf by:
D.M. Lavigne, M. Earle, S. Innes, G.A.J. Worthy, K.M. Kovacs,
O.J. Schmitz, J.P. Hickie, S.J. Holt, R.D. Ryder, T. Regan, W.G. Watson,
P. Singer, W.J. Jordan, M. Bruce)

International Seal Committee

Jeffords, Hon. J.M., House of Representatives,
Congress of the United States

Karlsen Shipping Company Ltd.

Kilabuk, D.

Labelle, R.

Labrador Inuit Association

Lantos, Hon. T., House of Representatives,
Congress of the United States

Lifeforce Foundation (P. Hamilton)

Lobster District 4B Working Group, (R.W. Jones)

Lobster District 5A and B Working Group (R.P. McClung)

Lobster District 7A, 7A1, 6A Working Group (R.E. Britten)

Local Development Committee of Fleur-de-Lys, (G.R. Walsh,
M.P. Lewis)

Mackey, M.G.A.

Makivik Corporation

McCloskey, W.B.

McGrath, R.

Mississauga Animal Rights Society

Mowat, F.

Nettles, W.G.

New Brunswick Department of Fisheries

Newfoundland Department of Rural, Agricultural and
Northern Development

Newfoundland Fishermen, Food and Allied Workers Union, Local 1252

Newfoundland and Labrador Federation of Municipalities (W. Dixon)

Newfoundland and Labrador Wildlife Federation (R. Bouzan)

Newfoundland Shipowner's Association

Newfoundlanders Against the Seal Hunt (M. Pumphrey)

Nova Scotia Department of Fisheries

Pauktuutit (Inuit Women's Association)

Prince Edward Island Department of Fisheries and Labour

Prince Rupert Fishermen's Cooperative Association

Rompkey, Hon. W., Member of Parliament,
Grand Falls - White Bay - Labrador

Rowsell, H.C.

Royal Norwegian Ministry of Fisheries (T. Øritsland)

Royal Society for the Prevention of Cruelty to Animals

Rushton, D.

St. John's Board of Trade

Scheffer, V.B.

Seafood Producers Association of Nova Scotia

Société Linnéene du Québec Inc. (M. Carbonneau, B. Gauthier)

Southern Shore Development Association

Southwest Arm Regional Development Association

Symmes, A.

Terhune, J.M.

Tompkins, S.

Tungavik Federation of Nunavut

Union européenne contre l'emploi abusif des animaux

United Church of Canada

University of Victoria Animal Rights Society

Veevee, P.

Wenzel, G.W.

Wilderness Society of Newfoundland and Labrador

Woodcock, G.

World Society for the Protection of Animals (T.H. Scott)

World Wildlife Fund - Canada (M. Humel)

World Wildlife Fund/International Union for the Conservation
of Nature and Natural Resources

3. Witnesses at Hearings of the Royal Commission

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6. Technical Reports of the Royal Commission

These reports have been deposited with the Headquarters Library, Dept. of Fisheries and Oceans, Ottawa, and with the Pinniped Bibliography, Dept. of Zoology, University of Guelph, Ontario.

1. Cooke, J.G., A.W. Trites, and P.A. Larkin. 1986. A review of the population dynamics of the northwest Atlantic harp seal (*Phoca groenlandica*).
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5. George, R.E. 1986. Estimation of costs of fish processors in Newfoundland and Nova Scotia attributable to *Pseudoterranova decipiens*.
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12. Market and Industry Analysts. 1986. A study on the world market opportunities for Canadian seal products.

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17. Ryan, S. 1986. A historical overview of Canadian/Newfoundland/world sealing and the part this industry played in the development of the Atlantic Canadian/Newfoundland economy.
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20. Williamson, H.A. 1986. Sealing in Labrador.
21. Compendium of observer reports concerning humaneness of the Canadian seal hunt.

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1. Harp seals in the Gulf of St. Lawrence.
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Chapter 2

1. Sealers on the ice at the Front (circa 1920s).
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2. Ringed seal.
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Chapter 3

1. Stretching sealskins (Northwest Territories).
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2. Hooded seal and blueback pup.
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1. *The Rainbow Warrior* in the Gulf.
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2. Adult harp seal and whitecoats.
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4. Atlantic whitecoat hunt.
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5. Inuit skinning bearded seal.
Arctic Biological Station, Ste-Anne-de-Bellevue.

Chapter 6

1. Harbour seal.
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2. Northern fur seals.
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1. Send-off of the sealing fleet.
Provincial Archives of Newfoundland and Labrador.
2. Discharging seals from *SS Eagle*.
Provincial Archives of Newfoundland and Labrador.

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1. Igloo at night (circa 1960).
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2. Conditioning sealskin by chewing it (1951).
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3. Seal hunter and sled.
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4. Naalak Nappaaluk (seal hunter) with Charlie Arngak.
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5. Inuit hunting camp (circa 1940).
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6. Inuit hunter and catch.
Arctic Biological Station, Ste-Anne-de-Bellevue.
7. Cleaning sealskins.
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Chapter 14

1. Sealing vessel near the Front.
Public Archives of Canada / PA 128771.

2. Deblubbing sealskins, St. John's (circa 1920).
Provincial Archives of Newfoundland and Labrador.

Chapter 15

1. Discharging sealskins, St. John's.
Atlantic Guardian / Public Archives of Canada /PA 145967.
2. Crew's quarters on sealing vessel.
Provincial Archives of Newfoundland and Labrador.
3. "Copying" at the Front.
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4. Landsman sealer, Magdalen Islands.
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